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AUTHOR Spence, Carol M.
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ABSTRACT

Some insight into the relationship between language and thought can be achieved through a comparison between American Sign Language and English. This paper discusses several studies on this topic and defines some of the problems. The author feels that the deaf using American Sign Language cannot be considered linguistically deficient. A structural analysis of sign language reveals phonemic, syntactic, and semantic features in a rich, complex structure. The author presents an evaluation of competence in expressive and receptive English. There is an analysis of American Sign Language and a discussion on acquisition and the effects of an early use of sign language. The author summarizes studies comparing hearing and deaf subjects on nonverbal cognitive tasks and criticizes a language deficiency experiment. A list of references is included. (VM)

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AN EVALUATION OF THE COMPARISON OF HEARING AND DEAF SUBJECTS TO INVESTIGATE THE LANGUAGE-THOUGHT ISSUE

Carol M. Spence

May 1971

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Introduction

Furth (1966) in Thinking without language offered experimental data and a theoretical interpretation which represents one pole of the language influences thought--thought influences language continuum. The other pole of the continuum is represented by Whorf (1966) who proposed that all higher levels of thinking are dependent upon language and that the environment is understood in terms of the structure of the language employed. Between a Whorfian position and a Furthian position fall many views which don't pose such an extreme view point and which consider the role of language through the process of mediation. The language-thought issue was being debated by the Cartesians and the romantics in the 17th and 18th centuries; it has been an issue as long as people have tried to explain the way men represent the world around them and their interaction with that world.

Furth (1966) studied the performance of deaf children and adults on various cognitive tasks in an attempt to test the validity of Piaget's (1968) view that the development of language is not a necessary precursor of the development of cognition. Furth bases his approach on the principle of the deficiency experiment. In this approach, some variable (e.g., language) is hypothesized to account for the ability of subjects to perform some task (e.g., conservation of weight). If subjects (e.g., deaf controls) can be proven to be deficient with regard to the variable in question (e.g., language) and at the same time can be shown to perform as well as subjects not

deficient with regard to this variable (e.g., hearing subjects), then one can reasonably conclude that the variable in question is not crucial for performance of the task. In addition, Furth notes that inability of the deaf controls to perform the task does not provide conclusive proof that the variable in question is related to task performance, since other uncontrolled factors (e.g., general experiential deficiencies) may be influencing the results. Furth (1964, 1970, 1971) has provided extensive reviews of studies comparing hearing and deaf subjects and concludes that the thinking processes of the deaf are very similar to those of hearing subjects and for this reason such processes cannot be explained in terms of language skills.

The use of a deprivation or deficiency paradigm has been accepted in this paper as a legitimate means of ascertaining the relative influences of language and thought. The main issue is the appropriate choice of control subjects; i.e., do the deaf satisfy the criteria (whatever they may be) for linguistic deficiency? This paper will evaluate only whether Furth has chosen a control group which can be said to be reliably deficient in the variable in question, that of language. Language is used to mean the manner in which people of a society communicate information necessary for their day-to-day activities; language is also used to refer to a means of communication which is systematic in terms of the utterances generated and in terms of the rules which can be said to describe its production. The author prefers Bartlett's (1932) definition of cognition or thought; "the capacity to turn round upon its own 'schemata' and to construct them afresh" (p. 206). However, in this

paper, cognition or thought will be defined in terms of the various tasks used by Furth and other researchers to measure cognitive functioning.

Although Furth provides a convincing case for the fact that the deaf are linguistically deficient with regard to their use of English, he does not adequately consider the possible role of sign language proficiency in their performance. Therefore any attempt at evaluating Furth's use of a deficiency experiment approach must include an analysis of American Sign Language and whether it can be considered a language; i.e., does it have as rich and complex a structure as does English and does it appear to be rule-bound in its generation? It will be this author's contention that sign language must be considered a language when one is evaluating the relative influences of language and thought. Therefore, the deaf adolescent and adult do not provide an adequate control group for the deficiency paradigm. The situation with the young deaf child (at an age comparable to that at which a hearing child has developed language) is equivocal.

Given that a judgment is made concerning the structural complexity of sign language, the problem then becomes one of determining the influence of this structure on the cognitive functioning of the deaf. Although data will be presented on the effects of early oral versus early manual training on later communicative and educational skills, and although studies will be proposed in which the effects of sign language on cognitive functioning might be tested, a thorough investigation of the effect of either English or sign language on cognitive functioning cannot be attempted in this paper.

The purpose of the paper, then, is to first review the data on the deaf's expressive and receptive abilities in English. After concluding that the deaf are deficient in English language skills, an attempt will be made to substantiate the view that American Sign Language is a structurally complex language, followed by a review of the few studies which have compared the effects of early manual and early oral language training methods. Furth's findings on comparisons of hearing and deaf subjects will be briefly summarized along with some data which presents problems for his interpretation. It will be concluded that given Furth's very restricted criterion of linguistic deficiency, reading ability in the English language, deaf persons are appropriately used in the deficiency experiment to investigate langaage and thought questions. However, it is the main thesis of this paper that the criteria for linguistic deficiency must be inclusive enough to accept ability to sign American Sign Language as evidence of language proficiency. Given such expanded criteria, and considering the data presented in this paper, deaf adults, at least, can not be considered appropriate controls in a deprivation experiment paradigm.

Use of Deaf Subjects in the Deficiency Experiment

The Nature of Deafness

Definitions--The term deaf refers to those people with non-functional hearing for everyday situations while the term hard-of-hearing refers to individuals who can understand spoken language with a hearing aid but evidence some hearing loss. There is a growing tendency to eliminate the term deaf and

replace it with the term hearing impaired since there are few instances of total hearing loss or deafness (Hardy, 1967). The onset of deafness is a crucial variable for the use of hearing impaired subjects in research conducted by Furth and others. The terms congenital (deafness present at birth) and adventitious (deafness acquired later in life due to illness or accident) do not clarify the situation since the crucial factor is onset of deafness prior to the acquisition of language. Knowing the onset of deafness is of importance in predicting the relative effectiveness of the two basic teaching methods, oral and manual, and consequently, success in mastering written and spoken English. A minimum requirement in a deficiency experiment is subjects who have become deaf prior to the acquisition of language. DiCarlo (1964) indicated that an individual with a hearing loss of 80 db or more in the speech range before language is acquired can be reliably diagnosed as deaf. Meadow (1967) estimated that of the total population of the U.S., 160,000 evidenced early total deafness and that the percentage of children deafened after age three (would have acquired some language) had decreased from 38% in 1910 to 29% in 1929 to 5% in 1967. Illnesses used to be the major causes of deafness, but advances in medical research have practically eliminated the chances of adventitious deafness.

No single factor can be designated as the cause of deafness. The following etiologic factors are involved in various cases: genetic determinants; prenatal viral infections such as maternal infection with rubella during the early stages of pregnancy; postnatal factors such as middle ear and upper

respiratory infections (Hardy, 1967). Northern, Teter, and Krug (1971) with a sample of 152 deaf adults reported that the etiology of deafness for 61.3% involved unknown or congenital factors. DiCarlo (1964) noted that more and more deaf children are multiply handicapped (e.g., the deaf-cerebral-palsy-child), another factor which has implications for research with the hearing impaired.

Educational Practices--Four types of schools exist for the deaf: state residential schools; public day schools (available only through the 6th grade); public day classes in regular public schools; private schools. In general, the day schools have emphasized the oral approach which combines instruction in lipreading and in the reading and writing of orthographic forms of English from the time the child enters school; the pure oral approach begins with lipreading and progresses from sound elements and combinations to phonetic spelling of words to regular spelling of words, and finally to reading and writing. For the most part, the manual method (use of American Sign Language to be described in greater detail in a later section) is not used as a teaching technique (Kohl, 1966). Meadow (1967) notes that children whose parents favor the teaching of sign language (usually deaf themselves) will be more likely to attend residential schools where signing seems to be slightly more accepted (if not among the administrators and teachers, definitely among the children outside of class). Two other methods of instruction can be found in schools for the deaf. The "natural language" approach developed by Groht (1958) involved an activity oriented program where children learned language contingent upon

what activity they were involved in at the time. Kohl (1966) attributed this approach to the influence of Dewey on education during the time Groht operated her program (1923-1958). The Rochester method combines the oral method with the use of the manual alphabet in a consistent use of English; signs are totally eliminated from this approach. Nineteen hand configurations plus three attitude changes of these configurations and two configurations with movement represent the 26 letters of the English alphabet or the manual alphabet. In fingerspelling, words are literally spelled-out (e.g., k, n, o, w) whereas in sign language, the referents of words are represented by a single sign (e.g., touching the forehead with fingers of a slightly bent hand is the sign for know--Stokoe, 1960). Fingerspelling provides a bridge between American Sign Language and English.

The oral versus manual approach controversy began in the late 1800's when the oral method succeeded the manual approach which had predominated during most of the 19th century in this country. At the time of the change-over in approaches, a large percentage of children as noted above had lost their hearing after acquiring language and instituting oral methods to preserve any residual speech made sense. However, today when the incidence of adventitious deafness has been just about eliminated, basing the entire teaching approach upon lipreading as do the 4 approaches (pure oral, oral, natural language, Rochester) described above has only resulted in the great majority of deaf children not mastering English at any level as will be documented below. Two other reasons have been given for emphasizing an oral teaching approach with deaf children.

One is the fact that the deaf live in a hearing world and that they must acquire a written and oral competency in English in order to survive in our society. Along with this argument is the assertion that if a child is taught signs he will not be motivated to learn English and will be therefore at a disadvantage in a hearing society. A second reason for the emphasis on an oral approach is the implicit assumption that thinking takes place in language form and that the deaf will not be able to function cognitively unless they are taught English (or some language). This paper will present data which contradict these assumptions and which show why increasing numbers of teachers of the deaf and researchers in the field (Vernon, 1969; Furth, 1966; Stokoe, 1960 to name a few) are presenting the case for the use of sign language in the teaching of the deaf.

Evaluation of Competence in English

Given that the aim of educators of the deaf in this country has been to teach language (i.e., English) to the deaf with special emphasis on speech and lipreading, it is appropriate to examine their success; i.e., what are the expressive and receptive abilities of the hearing impaired with regard to English? We will see in the following section that very few of the deaf abe able to speak English. Because they can not speak intelligibly, deaf adults communicate with the hearing world through writing. Written notes are used by even those proficient in speech and speech reading in public places, expecially when time is an important factor (e.g., standing in line at a drive-in). However studies to be reported indicate that the deaf function well below the hearing in terms of writing skill.

Speech-reading skills are not adequate enough to allow a deaf person to be able to understand the speech of hearing persons. In addition, speaking and speechreading skills are not sufficient to allow this form of communication to prevail among the deaf themselves; the great majority of deaf adults communicate with each other via the language of signs which will be described in a subsequent section. Finally, it will be seen that the deaf are deficient in another English receptive skill, that of reading.

Before reviewing separately the data for speech, writing, speechreading, and reading skills of the deaf, a study by Goda (1959) will be presented as a summary of all four areas.

TABLE I

Mean language measures by age groups: 12, 13, 14, and 16 to 18 years, with Ns of 10, 13, 17, and 16, and mean IQ's of 96.5, 96.3, 91.4, and 103.1, respectively.

Language Measures	Age 12	13	14	16-18
Length of Written Composition in words	195.6	193.1	182.8	198.1
Development of Written Sentence (maximum score, 11)	4.5	4.1	3.5	5.1
Length of Written Sentence in Words	7.9	7.6	6.7	8.7
Length of Spoken Composition in Words	101.0	99.0	83.5	108.2
Development of Spoken Sentence (maximum score, 11)	4.7	4.2	3.5	4.7
Length of Spoken Sentence in Words	6.0	6.2	5.5	6.8
Lipreading (maximum score 90)	37.1	37.5	28.2	53.8
Reading Grade Level	3.1	2.7	2.6	4.2

Goda (1959, p. 371)

A correational analysis led the authors to conclude that deaf children who show proficiency in one language skill will do well in other types of language skills and those deaf children who have difficulty with one language skill will tend to have difficulty with other language skills. Development of the spoken sentence and total amount of speaking had significant negative correlations with age. This effect was explained by the authors as possibly due to the de-emphasizing of oral language after age 12 in the sampled school (and in many other schools for the deaf); possibly the deaf child at age 12 has reached a plateau with regard to the use of oral speech.

Expressive, Speech--Coleman (unpublished paper, 1968) reviewed studies of deaf speech and noted the following problems for the understanding of their speech by hearing persons: "slow and labored speech accompanied by high chest pressure and uttered with an excess amount of breath; prolonged vowels with consequent distortion; abnormalities of rhythm; excessive nasality of vowels and consonants; improper function of consonants with the consequent addition of extra syllables at points between abutting consonants" (p. 4). She noted the importance of rhythm for speech intelligibility; a sentence spoken with incorrect rhythm will be understood only one quarter as often as a sentence spoken with correct rhythm. The hearing impaired tended to break sentences into shorter breath groups, to either misplace or add accents on syllables, and to incorrectly add or omit syllables; all of these factors affect the rhythm of the sentence. Consonants which are of more importance in understanding speech than vowels were malarticulated more often (almost twice as

often in one study reviewed by Coleman). Pitch and intonation patterns are different for hearing and deaf speech.

In addition, Coleman noted that the intelligibility of deaf speech decreases with age, usually due to the fact that increasingly more complex vocabulary and sentence structure are expected from older children with less tolerance for errors; the increased vocabulary and sentence structure involves more complex articulation requirements. Furthermore, as the children get older, the emphasis is increasingly shifted to more complex content (e.g., school subjects) instead of just speech articulation. Intelligible speech is more likely to be manifested if the deafness is acquired later in life so that experience with speech and how it sounds (including the suprasegmental or prosodic cues just mentioned) has been acquired. Functional speech is also more likely if the hearing impairment is not severe so that some residual hearing remains which can then be amplified and trained.

No estimate was found by this author with regard to the percentage of hearing impaired who develop intelligible and functional speech. Many writers in the field note the total failure of attempts to teach the deaf to talk and mention is usually made of the fact that only the most exceptional deaf person learns to speak intelligibly. It doesn't appear that any large scale study has been conducted to answer this question. However, several studies deal with this question on a more limited basis. Harvey, Gochour, and Minkin (unpublished paper, 1971) conducted a study for the Northwest Regional Rehabilitation Program for Adult Deaf at the Seattle Hearing and Speech Center and found that 22 of the 55 (i.e., 40%)

individuals for whom scores were available had generally intelligible speech. Since this evaluation was made by personnel at the Center who are trained in working with the deaf, the number placed in the highest category of speech intelligibility is probably inflated; i.e., untrained hearing persons probably would experience difficulty understanding many of the subjects placed in this category. In addition, the Seattle Hearing and Speech Center study found that 17 out of 21 subjects judged to have the most intelligible speech also had the highest level of auditory discrimination (i.e., could identify words presented auditorily on a standard test put out by the Central Institute for the Deaf). Rainer, Altshuler, and Kallmann (1969) reported that only 24% of 167 deaf persons participating in an outpatient mental health clinic had speech which was considered adequate enough for speech-alone interviewing. The other 76% could be counseled only by staff members who had a thorough knowledge of sign language.

Northern et al. (1971) looked at the amount of confidence deaf adults had in their ability to speak and be understood. Fifty-seven per cent of their sample felt that strangers could get "some" of what they said, while only 12% felt that strangers could understand most of what they said; 35% said they thought that strangers could understand all of what they said. This lack of confidence in speech ability leads most deaf to written forms of communication with the hearing world; Watson (unpublished paper, 1968) and Northern et al. reported that 60% of their subjects would need to rely on manual or written forms of communication. Studies reported by Northern et al. and

Rainer et al. (1969) indicate that among themselves deaf persons communicate mainly with signs or a combination of signs and speech.

In summary, if one considers the information from studies such as those reviewed by Coleman, it becomes clear that if the hearing impaired manifest the number and type of errors reported, their speech for the most part is unintelligible to most hearing speakers who use all of these cues (e.g., pitch, intonation, rhythm) in understanding speech. Workers in this field who have an understanding of the speech errors made by the deaf can compensate for this and look for these errors in listening to the deaf talk. However, it seems safe to conclude that the untrained hearing person would have great difficulty in understanding a deaf person's speech. The fact that the deaf usually communicate with hearing persons via the medium of writing brings up the question of how skilled the deaf are in a second expressive index of English language ability, that of writing.

Expressive, Writing--Myklebust (1960) found the following discrepancies between the writing ability of hearing and deaf children. (7,9,11,13, and 15 years old) who were asked to write a story about a picture. Length of sentence for the deaf at age 15 was comparable to that of the hearing at age 7. Fifteen year old deaf children performed similarly to seven year old hearing children in terms of a general syntax score which considered errors in parts of speech, substitutions (A boy will playing), omissions (A boy playing), additions (A boy is he playing), word order (A boy playing is), and punctuation. Deaf children, especially the younger ones, made use of a

"carrier phrase" (i.e., a series of sentences in which only the noun is varied such as I see boy, I see dog, I see baby) to a much greater extent than did hearing children. In addition, the deaf made more omission errors than did the hearing and tended to omit essential words (e.g., A boy playing). Deaf children used many more nouns and fewer verbs at each age level, especially at age seven; their use of pronouns, adjectives, prepositions, and conjunctions was considerably delayed and consistently less frequent than that of the hearing children. Myklebust concluded that the verbal behavior of the deaf is more concrete than that of the hearing because the deaf use "much more language of the 'naming level' type" (p. 309). However, he noted that the ability to use abstract thought was non synonymous with verbal facility since the deaf were much more similar to the hearing on a measure of the extent to which abstraction was used in the stories than they were on the straight language measures.

Cooper (1965) looked at the development of morphological patterns in hearing (7.4 to 13.6 years of age) and deaf (7.2 to 19.9 years of age) children. The Brown (1957) and Berko (1958) techniques were used to measure inflectional (e.g., the -s in farmers) and derivational (e.g., the -er in farmers) suffix development. Although receptive and productive scores increased with age for both groups, the average performance of the deaf was below that of the hearing; the total morphology score of the 19 year old deaf group did not equal that of the 10 year old hearing subjects. Inflectional scores were superior to derivational scores for both hearing and deaf subjects.

Both groups of subjects performed better on receptive measures than on productive measures. Deaf subjects performed similarly to hearing subjects when both groups were matched for reading achievement. Cooper concluded that the hearing impaired do learn certain English morphological patterns but that the development is slower and at a lower level in the groups of deaf subjects.

Cohen (1965) studied the predictability of story paraphrases written by hearing and deaf children. Children were asked to read a story and rewrite it in their own words; words were deleted from both the hearing and deaf paraphrases and from the original passage. The children were asked in a second session to restore the deleted word in the various mutilated passages. Cohen believed that the deaf might have a different structural organization of the English language which would result in their messages having less predictability for the hearing subjects and vice versa because the groups do not share a common set of verbal habits; deaf paraphrases might be more predictable to the deaf because they share a common set of rules. The results showed that hearing subjects were much more likely to misunderstand deaf paraphrases (i.e., could not restore the correct word as often) than they were to misunderstand the messages in their own paraphrases or the original passages. The deaf were equally likely to misunderstand hearing and deaf paraphrases. Cohen concluded that "the deaf group had not learned either to recognize or produce the typical sequential dependencies of English as well as the hearing group had learned to do so, and that this poorer learning interfered with the correct prediction of deaf communications by hearing subjects

and with the predictuion of hearing messages by deaf subjects" (p. 35). This study shows the possibilities for misunderstanding that could occur when deaf persons write messages to hearing persons especially when they tend to omit many words which a hearing person would not omit.

It seems safe to conclude from this review of expressive capabilities in English that the deaf for the most part are unable to produce English via speech or writing on a level which indicates an understanding of the basic structure of the English language or on a level which allows for consistently correct reception on the part of hearing persons. Therefore if the criterion for deficiency involves facility in the English language then, in terms of expressive capabilities, the deaf evidence if not a total deficiency a functional deficiency which would be appropriate for inclusion in a deficiency experiment. We will now consider evidence regarding the deaf's receptive abilities in English.

Receptive, Speech--The deaf must receive speech in the two modalities of vision and touch but most training is through vision alone (i.e., speechreading or lipreading. Kohl (1966) noted that there are certain phonemic contrasts in English which cannot be distinguished on the lips of speakers; e.g., cart and yarn appear very similar and a word like hit which is formed at the back of the mouth cannot be lipread.

A study by Woodward and Barber (1960) gave further evidence for the view that speech perception for the deaf involves more than making visual judgments about articulatory movements. Subjects were presented pairs of syllables (e.g., pa-ka or pa-pa) and were asked to classify these pairs as

different or alike. On the basis of these responses, the authors proposed "(a) a rank order of visual perceptibility of consonant phonations, and from this, (b) a hierarchy of visual contrastiveness among the phonetic differences which are assumed to be crucial in the aural perception of speech" (p. 213). Woodward and Barber found only four visually-contrastive units out of the 24 initial consonants tested. Of the four units, only three (which involved labial and labialized consonants) had a high visibility value; Unit 1 (p b m); Unit 2 (W w r); Unit 3 (f v). The authors stated, "Of those phonetic dimensions which define the significant articulatory differences in English speech, almost all--including articulation type, resonance type, voice, affrication, palatalization, and all areas of articulation except labial--are virtually neutralized as factors of difference in visual perception" (p. 219). In addition, they noted that if lipreaders were to discriminate among the types of phonemes in Unit 4 (e.g., t, d, n, l, etc.--alveolar, dental, alveo-palatal, velar, and glottal phonemes), "it must be on the basis of phonetic, lexical, or grammatical redundancy, since the articulatory differences among them are not readily available to visual observation" (p. 219). The subjects used by Woodward and Barber were normal hearing speakers of English because the purpose of the study was "to discover the linguistically-determined units of visual speech perception" and the hearing impaired would "to some degree lack the sensory experiences of hearing-speaking exchange" (p. 218). Hearing impaired subjects trained in lipreading would have done better than the hearing subjects used in this study but the data still give a pretty good picture of the problems involved in the visual perception of speech.

Fifty-seven per cent of the Northern et al. (1971) deaf adult sample indicated that they could only understand "some of what was said" via speechreading while 12% reported that they could not understand anything through speechreading; 29% said that they could understand "most of what was said." Therefore, this study showed that over two thirds of the sample could understand very little of the incoming message through the medium of speechreading.

In order to receive the message being spoken, a hearing impaired person must fill in the blanks that cannot be perceived by observing the speaker talk. The ability to fill in the blanks is a function of the hearing impaired person's knowledge of the lexical and structural properties of English. The data presented above on expressive capabilities of the deaf with regard to English show that the deaf do not have an adequate grasp of the structure of the English language; Cohen's (1965) data showing that deaf subjects failed to utilize the typical sequential dependencies used by hearing subjects are particularly relevant to the problems of lipreading. Therefore, teaching lipreading skills which depend upon knowledge of the structure of the language but which are supposed to provide the knowledge of that language only results in a vicious circle for the hearing impaired.

Receptive, Reading--Furth (1966) based his contention that the deaf are linguistically deficient on the special deaf norms for the Metropolitan Achievement Tests Elementary Battery published by Wrightstone, Aronow, and Moskowitz (1963). Furth presented the following table which compared the deaf norms with norms for a national hearing sample.

TABLE II

Silent Reading Achievement of Deaf Pupils
Compared to Grade Equivalent of Hearing Norms

Age	N	Mean Raw Score and Stand. Dev.	Mean Grade Equivalent	Percentage Scoring at Grade 4.9 or Above
10½-11½	654	12.6 (8.1)	2.7	1%
11½-12½	849	14.9 (8.5)	2.8	2%
12½-13½	797	17.6 (9.1)	3.1	6%
13½-14½	814	18.7 (9.3)	3.3	7%
14½-15½	1035	20.8 (9.3)	3.4	10%
15½-16½	1075	21.6 (9.5)	3.5	12%

Furth (1966, p. 14)

Furth pointed out that reading tests below grade 4 do not require a knowledge of linguistic ordering or structure and that the inference of linguistic competence would require a reading level of at least grade 4. The fact that only 12% of the deaf scored at grade 4.9 or above supports the previous contention that the deaf do not have an understanding of English language structure. Furth noted the fact that the deaf children did not advance a full grade level in reading ability between the ages of 10 and 16. The deaf adolescent may know quite a few English words but he cannot comprehend or produce combinations of these words which approximate the structural complexity involved in fourth grade reading ability. In addition, Furth argued that the reading deficiency noted above is not comparable to reading problems evidenced by hearing children; the hearing child can speak and understand English even though he may be a poor reader. The deaf, on the other hand, do not show a mastery of English on any level.

Pinter and paterson (1917) did one of the earliest studies of the language ability of deaf children. Using the Trabue Language Scale which involved filling in the correct word in a blank space in a sentence (e.g., _____sits; A boy_____; Mary_____Edith) with 570 deaf students in two schools for the deaf, they reported that after 13 years of work the grade ability of the deaf was only 4.25. Moores (1970) felt that judging the deaf's proficiency in the English language via reading achievement scores provided an inflated estimate of language ability since multiple choice responses are involved. Therefore, he used a technique similar to that used by Pinter and Paterson in which passages chosen from a fourth, sixth, and eighth grade reading texts had every fifth word deleted. This technique, known as a "cloze" procedure (and similar to that used by Cohen, 1965) tests the ability of the subject to use semantic and grammatical contexts as the basis for predicting the deleted words. Hearing subjects (average age of 9-10 and mean reading achievement at grade 4.8) were better than deaf subjects (average age of 16.9 and mean reading achievement at grade 4.8) at predicting deleted material and showed a higher level of both grammatical and vocabulary functioning.

Furth (1966) has claimed that deaf children and adults are linguistically deficient. The studies presented on speech, writing, speechreading, and reading skills of deaf children and adolescents overwhelmingly support Furth's contention that the deaf are unable to produce and comprehend the English language on any kind of functional level. What has not been proved by this research is the contention that the deaf are linguistically

deficient, i.e., that the deaf do not have language. Since most deaf persons communicate among themselves via the language of signs as soon as they have any interaction with other deaf people, before one can accept the linguistically deficient label, one must prove that American Sign Language is not a language. The next section of this paper will be addressed to this question and an attempt will be made to support the view that sign language has phonological, syntactic, and semantic complexity and is just as much a language as is English.

Analysis of American Sign Language

History--There are only a few isolated instances prior to the middle of the eighteenth century of individuals teaching deaf persons to communicate via the language of their culture. Pedro Ponce DeLeon, a Spanish monk, taught the children of several noble families in Spain to read, write, and speak during the sixteenth century. The impetus for his work with these children grew out of the desire of the families to enable their children to inherit family estates. There is no record of the methods used by Ponce DeLeon to teach these children. In 1620, Juan Martin Pablo Bonet published the first book on the education of the deaf in which he proposed the use of a one-handed manual alphabet as an initial step in educating the deaf child. The alphabet developed by Bonet is basically the same manual alphabet used by the American deaf today.

However, the most important figure in the history of sign language was a French priest, L'Abbe de L'Epee, who in 1750 attempted to teach 2 deaf-mute sisters. This led to his opening the first public school for the deaf in Paris in 1755 and the

publication of his teaching method in 1776. He was concerned with educating his pupils first and only later teaching them the French language. L'Épeé utilized the language of the deaf which he called the "natural language of signs." Stokoe (1960) discussed the use of the word, natural, and pointed out that there are relatively few signs where the pantomine and the action being conveyed are identical (e.g., eating). Instead, many signs which developed did so in terms of some "specific set of circumstances <u>in that culture</u>" (p. 11). L'Épeé used a meta-language or his signes methodiques for teaching the complexities of French grammar. He utilized any signs which existed and built upon them to indicate greater complexity. For example, the deaf indicated past action by throwing their hand back over their shoulder once or several times. L'Épeé used once over the shoulder to represent the simple past, twice over the shoulder to represent the perfect and three times, the pluperfect. There were no signs for articles so L'Épeé used a crooked index finger at the brow to represent <u>le</u> and a crooked index finger at the cheek for <u>la</u>. The crooked finger was to remind his pupils that in using an article, they were choosing one of the possible instances of the noun. Touching the brow for <u>le</u> represented a man tipping his hat while touching the cheek referred to the very noticeable termination of women's hairstyles of that day. The signs for male and female in American Sign Language are basically the signs for L'Épeé's <u>le</u> and <u>la</u>. Students who had completed his course could translate from any one of the languages (i.e., natural or methodical signs or French) into another. Other methods of educating the deaf

were being developed in France, Germany, and England but were basically oral in approach. The methods used in these various approaches were closely guarded secrets and only periodically did teachers demonstrate the results of their particular method.

L'Épeé was succeeded by one of his students, Abbe Sicard, who in turn produced two students who contributed a great deal to deaf education. Sicard continued L'Épeé's work with manual communication and much of the sign language used today in the United States has its origin in Sicard's work.

American exposure to the methods of L'Épeé and Sicard came through Thomas Hopkins Gallaudet's visit in 1815. Gallaudet was sent by a group of Hartford, Connecticut citizens (one of whom was the father of a deaf girl Gallaudet had tried to teach) who wanted information on the various European methods of educating the deaf. Gallaudet went first to London where he was refused permission to study the technique used in the London Asylum. However, while he was in London, he met Sicard and his most famous pupils, Massieu and Clerc. Gallaudet returned to Paris with Sicard and studied the methods of the Paris school. He returned to the U.S. with Clerc and opened the American School for the deaf in 1817. Clerc was the first deaf teacher of the deaf in America and the French Method of manual communication was the first approach used in instructing the deaf in this country. The Clarke School for the Deaf established in 1867 used the oral method of the German school and most schools after this time gradually incorporated the oral method. However, the state schools which had already been established throughout the country retained the manual method at least in the later years for children not benefiting from the oral method. Even

though the manual method was retained in many state residential schools, it lost the status and respect bestowed upon it by L'Epee and Sicard.

There is not just a single variety of sign language but a whole continuum ranging from the sign language used by the deaf with little knowledge of English through signing which incorporates many grammatical features of English to signed English which makes use of a large amount of fingerspelling to compensate for the many lexical and syntactical differences in the two languages. Stokoe (1970b) applied Ferguson's (1959) idea of "diglossia" (a situation where "two or more varieties of the same language are used by some speakers under different conditions"--p. 325) to the situation faced by the deaf in this country. Ferguson's "superposed" or "high" variety would be English which is signed and fingerspelled while the "low" or conversational variety is that which most deaf use among themselves. As Ferguson found when studying several languages (e.g., Arabic), people will generally deny useage of the "low" form and indicate their use of the "high" variety of the language. However, observation of individuals in informal situations indicated that under these conditions, the "low" form was usually employed. Stokoe reported finding signers who used only the "high" form and said they did not know the "low" form but under questioning indicated that they "might sign a little differently" (p. 4) to family than to people at college. These same signers when not discussing sign language with Stokoe were seen signing in a fashion which more closely approximated the "low" rather than the "high" version of signing.

Croneberg (Stokoe et al., 1965) has been especially interested in instances of sociolinguistic variation in American Sign Language. In such variation, "the speech of certain subgroups of the users of a language shows variation from a given or analytically derived norm in pronounciation, vocabulary, and syntax--but the variation does not preclude mutual intelligibility, even if some difficulties may arise" (p. 313).Croneberg discovered evidence of both horizontal (geographically based--usually called dialect variation) and vertical (socially based) sociolinguistic variation. He noted the importance of amount of contact involved among signers; i.e., the less the contact, the more the dialect variation. State boundaries often mark dialect boundaries. The presence of a school for the deaf is very important in the spreading of the dialect throughout an area; the young can learn the particular variety of American Sign Language for that locale plus invent new signs salient for their generation.

The "high" version or signed English and basic sign language differ in terms of a number of syntactic features; especially noticeable are the reduced or almost absent inflectional system and the different word order of sign language. For example, number is not indicated in sign language and the receiver must use the context of the signing for total meaning. A person using signed English can fingerspell an -s or es or can repeat the movement aspect of the sign to indicate plural. Sign language verbs are also uninflected. Again the time aspect is discovered through context or through the use of a sign such as yesterday or tommorrow; there is also a general sign for

past which involves throwing the hand back over the shoulder or forward from the shoulder if future is intended but most signers leave the tense to be picked up from the context. The fact that sign language does not inflect for number agreement and for tenses is used as an argument that the language lacks complexity. However, Chinese, considered a language by most, does not inflect for number, tense, case, or person and context is used effectively as in sign language (Jespersen, 1964; Chao, 1964). Facial and body expression are used to a much greater extent in sign language than in spoken English; such expressions take the place of the prosodic or suprasegmental features of English (pitch, intonation, etc.) and serve a syntactic function (e.g., a head dip indicates first person singular and certain eyebrow movements indicate that a question is being asked). G General concepts are communicated without the diversity allowed in English; e.g., Fant (1964) noted that a deaf person will sign tired to convey that general feeling and is not concerned about distinguishing between fatigued and exhausted--often facial expressions or the intensiveness with which the sign is made convey as many intricacies of meaning as do the many words in English.

Stokoe's Analysis--Stokoe (1960) was one of the first people to study sign language on a linguistic basis. He used the following definition of language based on one given by Trager: "it is the cultural system which employs certain of [the visible actions of the face and hand,] combines them into recurrent sequences, and arranges these sequences into systematic distribution in relation to each other and in reference to other cultural systems" (p. 30).

Stokoe's observations have been the most extensive in the area of comparing phonological behaviors of spoken and signed languages. The terms chereme and allocher correspond to phoneme and allophone. Signs and words can be considered equivalent although most people who study sign language warn against trying to find strict sign-word equivalents. Most sign language manuals advocate thinking in terms of the referent of the sign and not trying to match up an English word. Stokoe used the term cherology to stand for phonology. The deaf person is presented with two types of morphemes, the finger-spelled English word and the sign which is the basic unit of sign language. Stokoe's description is based on the sign as morpheme. The sign is made up of three aspects which are comparable to the vowel and consonant sounds in English. The word tab refers to a part of the signer's body in terms of position in space or in terms of the configuration of the non-moving hand; e.g., a fist configuration made at the chin means ice cream, at the forehead means Sweden, and at the chest means sorry. The word dez refers to the configuration of the hand which makes a motion in a tab. Sig refers to the movement or change in configuration of the dez in some designated tab. The meaning of this smallest unit, the sign, comes from the combination of all three aspects. The sign is not sequentially produced like the English word but is simultaneously produced. It is possible to distinguish allochers or markers of the aspects dez, sig, and tab which are not contrasted by signers. For example, one chereme involved with position is mid-face. Whether the signer touches the nose or a section closer to the eyes is dependent upon the dez and the sig involved. If the

forefinger of the dez hand is moving out from the face, the tab is more likely to be seen as the eyes (the sign for see). The nose and eyes are considered allochers of the tab mid-face. Stokoe described allochers for both dez cheremes and sig cheremes.

In terms of what Stokoe called morphocheremics, we find that the way in which the aspects of signs combine is ordered; i.e., not all combinations of tab, dez, and sig are lawful. A signer can use any dez with the single movements of circle, approach, touch, and graze with body tabs (certain combinations of movements are also allowed with body tabs). Another interesting patterning of cheremes involves using the configuration of the first letter of a word for the sign itself. Some of these signs use a zero tab (space in front of signer's where hand movement is easy and natural) and others combine the configuration with either a body or a configuration tab. At one time the sign for green used a V configuration (French word, vert) but now the sign uses a G-dez. This type of sign is mainly used locally among signers for personal names and locations.

The morphemic and syntactic description of sign language is not as complete or precise as that of the phonemic or cheremic description published by Stokoe. However a number of interesting observations and patterns have been discussed by Stokoe (1960, 1965, 1970c). There is only one instance of a suffix and it is similar to the English agentive suffix, -er. For example, if a signer wants to sign teacher, he first makes the sign for teach (the base); then he drops flat or bent hands down along the sides of the body to make the body, person, or

individual sign. In the same manner, a signer can make cook (noun) of cook (verb), student of learn, or typist of type.

Stokoe, Casterline, and Croneberg (1965) discussed the existence of parts of speech in sign language. Parts of speech will be in evidence if the signer signs with English syntax or in other words uses signed English! However, it is possible to distinguish classes of signs on a syntactic basis. The name signs function like proper nouns and not only can be used as adjectives but have a special cheremic history as mentioned above. It is not as easy to define a class of common nouns although there are some which can be repeated or reduplicated; if the movement or sig is done once, singularity is indicated, if repeated, plurality is indicated.

Stokoe et al. (1965) noted that it is easier to define classes of verb signs. One morphemic classification is words which will fill the blank in "one who ___s"; such words are called verbs. We have already discussed the use of the person sign which indicates that someone does what the verb sign specifies. Stokoe also discussed two classes of verb signs, one of which moves the dez toward the signer (have, take, get, accept, borrow, come, receive, learn, choose, want) and one which moves the dez away from the signer (give, lend, reject, teach announce, go, etc.). Stokoe referred to the sigs of toward (T) and away (⊥) as morphochers which form the basis of the morphemes, toward (-T) and away (-⊥); these morphemes are the source of the language meanings or definitions such as get, have, give, etc. This approach basis for verb sign classes reminded Stokoe of the flow of action in an English sentence in which action which originates with the subject procedes toward the

object who receives the action. This situation is very literally represented in sign language and because it is so clear, I as subject is often not signed, nor is you as object; subject and object are signed if the referents are not clear through context. Stokoe noted that many sign verbs are not included in this classification but that it is still a useful technique.

One difference between English and sign language has already been noted, that being the lack of tense inflection. Another difference noted by McCall (1965) was the lack of a sign equivalent to the English verb to be; she did not find any instances of such a sign. A sentence such as I am tired would be signed I tired, or as Stokoe (1965, 1970) noted it might be signed tired. However, sign language does use auxiliary verbs in a manner similar to that found in English. McCall defined a verb phrase as composed of an optional modal and a verb. Modals were expanded into four types: M_1 (want, need, like, let); M_2 (need, can, will, past--Falberg, 1963 showed uses of past as I past eat; M_3 (can't); M_4 (easy, hard, good, nice, happy).

Given some knowledge of the basic components of sign language, it is interesting to see how the signs are combined to form utterances. Stokoe et al. (1965) defined an utterance in sign language as moving "from some state of bodily activity having no linguistic significance into the opposite, and . . . [ending] when the linguistically significant activity changes back to its opposite"--"The signer . . . begins in repose, makes signs, and returns to repose" (pp. 274-275). They reported that approximately 90% of the time, signers return

their hands to the position they held prior to the position they held prior to signing. When signing a question, the signer either leaves his hand or hands in the last sig momentarily or moves them toward the person to whom the question is being addressed.

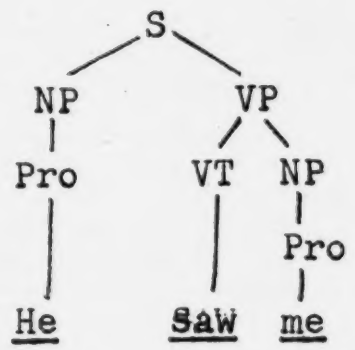
McCall (1965) described two basic kinds of sentences generated by phrase structure rules. One type involves either one gesture or a pair of gestures and can be used to indicate a total concept; e.g., I hate you can be expressed with one gesture. The second type consists of a predicate and the following optional elements: adverb of emphasis; noun phrase; time marker. An example of this second type is (Maybe) (John) help (tomorrow). Stokoe (1970c) criticized McCall's grammar in terms of the corpus from which it was generated. The signers were observed at picnics and other types of social situations; given that these signers were well acquainted or intimate friends, they would evidence more ellipsis and slang than would be found in a less casual situation. He noted that in the first two rules, more elements might be left out than left in the base sentence. However, nthe fact that most studies of sign language are attempting to analyze the signing typical of the deaf among themselves and not signed English would seem to justify McCall's choice of a signing situation.

When the hearing impaired combine signs, the order is often not equivalent to that of English Word order. Stokoe et al. (1965) reported that a semantic ordering can be found in signed utterances moving from the more general concept to the more narrow concept; i.e., a progression from wider to more exact notions. One example given by Stokoe involves the use of a sign indicating time (e.g., yesterday) which initiates the

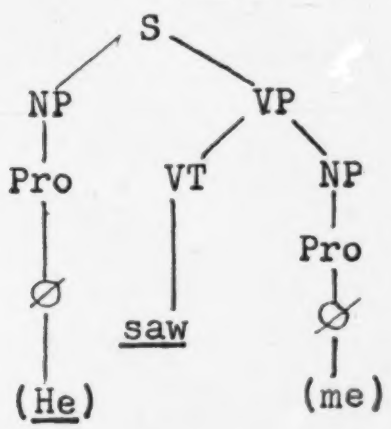
sentence; the action which falls within that time follows. Usually the order corresponds as much as possible to the actual order of events being described. In another example, Stokoe used the English phrase, the elevator in the Washington monument which can also be phrased as the Washington monument elevator; both English phrases retain the saliency of elevator through intonation patterns. The phrase will normally be signed only one way in sign language and that is Washington monument elevator; the city which denotes the more general concept is signed first, followed by the structure in the city, ending with a feature of the structure. Educators of the deaf have indicated to this author that often the most salient feature of an idea will be signed first. In addition, the author has asked those proficient in signing whether signers would use word order to distinguish between the cat bites the dog and the dog bites the cat. Some informants have indicated that English word order could be used by the deaf to communicate the two meanings. Stokoe (personal communication, April 1971), however, indicated that a more common order involves the object following the verb with the subject either before the verb (svo) or at the end of the utterance (vos); the sign directly after the verb is interpreted as the recipient of the action and sometimes is incorporated into the verb sign itself (as was explained earlier, the elimination of both subject or object occurs if context is sufficient to convey the message). A series of examples will now be presented to show how the signer communicates structural relationships in the utterance without a need for word order; i.e., other cues are present which make a reliance on word order unnecessary.

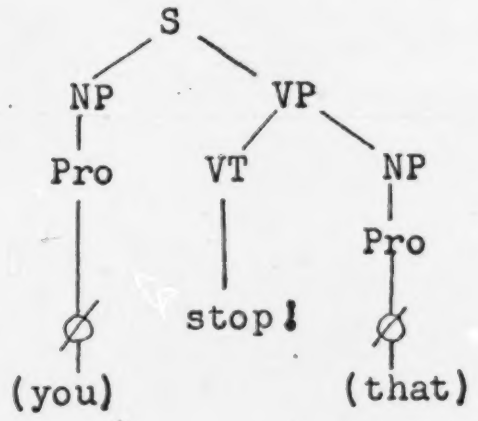
Stokoe (1970c) described several sentences which indicate the differences between the sentence patterns of English and sign language. The English sentence, He saw me has the following expansion rules and tree structure:

(1) S → NP + VP
NP → Pro
VP → VT + NP



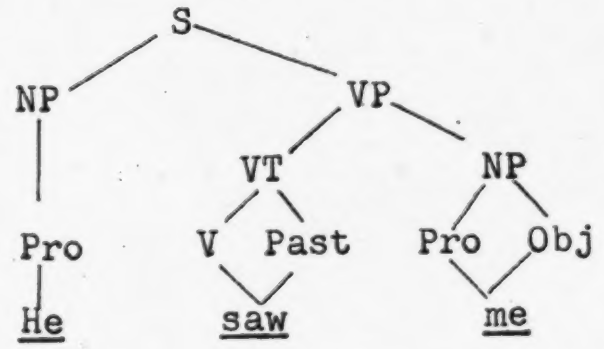
Stokoe noted that an observer would only see one sign on the part of the signer, but not one described in the manuals. He described the sign for see as "the V hand held up so that the fingertips are opposite the signer's eyes, back of the hand outward, is moved away from the face a short distance. Instead of this, the signer whose sentence is he saw me holds the V hand pointing obliquely out at about head level, looking at it, and with a flick of the wrist bends the fingertips toward himself" (p. 9). When the tree structure is drawn for the signed sentence, two symbols are not expanded which Stokoe likens to an English imperative sentence.

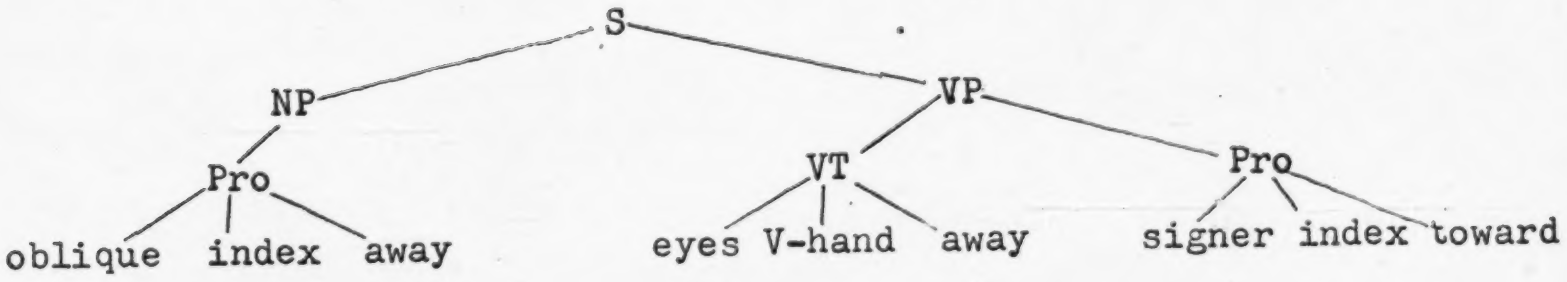




The signer conveys the meaning of the sentence through kinesics and through the context of the discussion in addition to "(a) .. changing the way of making the sign 'see' (which also means 'I see'), (b)..starting the changed sign 'see' with the hand held where it would be to sign 'him'or 'her', and (c)..moving the sign's prominent feature, the fingertips, toward the signer's self" (p. 10). The more complex tree structures were provided by Stokoe to further indicate the differences in the two sentence patterns along with a possible transformation rule to describe the change from three signs into one.

(2) S ⟶ NP + VP
NP ⟶ Pro (+Obj. in context VP)
VP ⟶ VT + NP
VT ⟶ V + Past





(3) oblique + index + away (= 'he')
eyes + V-hand + away (= 'saw')
signer + index + toward (='me') ⟹ oblique + V-hand + toward
('he') 'saw' ('me')

The important thing about the previous example is the fact that the signer is using the direction in which the sign is made to indicate subject-object distinctions in the sentence. Stokoe et al. (1965) used the example He gave me to further illustrate this syntactic feature of signing. The motion in the sign give is away from the signer indicating as mentioned previously a

logical extension of the action from subject to object or recipient; for this reason the signer often omits the signs for himself as subject and the other person as object for they are incorporated into the verb sign. If the signer wishes to indicate himself as recipient of the action as in He gave me, he simply reverses the direction of the movement in the sign for give, so that the motion is toward the signer. Another example was given by Stokoe (personal communication, April, 1971) in the sentence, English teacher show me book hold. The same order of signs would be used to indicate both I showed the English teacher the bookends and The English teacher showed me the bookends. The subject-object distinction is clarified by the two hands (index finger of right hand placed in the open palm of the left hand) moving out from the signer in the first example and moving toward the signer for the second interpretation. The head and eyes also provide similar cues for this syntactic distinction; for example, in the first interpretation, the signer's eyes would first look down and then follow the movement of thesign out away from the signer--if the second meaning were intended, the eyes would be focused at some distance away from the signer and move in with motion of the sign. In addition, Stokoe noted that the directo object pronoun usually would not appear in this utterance because it had been incorporated into the verb sign; he indicated that this omission is common in the signing of both deaf children and deal adults. Bellugi (personal communication, April 1971) was the one to first bring to the attention of this author the importance and use of the change of direction in signing a verb. She indicated that adult signers do not use all verbs in such a manner (e.g., the verb lead). This feature of sign language syntax will be referred to again in a subsequent discussion of the acquisition of sign language. It is clear that if a

language possesses such a feature, word order becomes a less important factor in the communication of subject-verb-object relationships in a sentence.

Stokoe (1970c) pointed out the complexity of sign utterances through the use of the following sentence, There's a man in there. The English version is composed of two sentences, A man is in there and There's something. A deletion rule to delete is is required to obtain the initial sentence, There's a man in there. The sentence in sign language is signed with just two signs, man and there. The utterance cannot be described as S→ man + there or S→ there + man although both orders are perfectly acceptable in sign language. The complexity of this utterance comes from the fact the the two signs are signed simultaneously and neither can be assigned any priority; current grammars cannot cope with this third order.

In summarizing the comparison between English and sign language word order, Stokoe's (1970c) description of the three conditions which will result in signed sentences with ord order similar to that of English is useful. These conditions are: (1) use of fingerspelling with signs; (2) knowledge and understanding of the signer with regard to English structure; (3) more formal occasions (e.g., attending a lecture or conversing with a hearing person) where signed English is normally used instead of the sign language of casual everyday living (as in Stokoe's discussion of sign language diglossia, 1970b).

It is important before concluding this discussion of sign language to re-emphasize the crucial role played by paralinguistic cues such as facial and body expression. As

noted previously, such cues make up for the lack of a larger vocabulary of signs by allowing the signer to indicate the degree or intensity of his message. Stokoe (1970c) characterized the difference between the size of vocabulary in both languages in terms of two mechanics' toolboxes. "One has a complete set of wrenches of fixed size to fit each different size of nut or bolt head he expects to come across. The other has just one adjustable wrench which will open wide enough for the largest nut and can be made to fit anything smaller." (pp. 33-34) The flexibility is provided through the "size, speed, tension, precision, and duration of the actions involved in signing" which are "all used and understood as message bearing fractions of total communicative activity" (p. 33). Those proficient in signing watch the face of the signer more than they do the hands.

The paralinguistic cues also serve a syntactic function as with the head dip indicating first person singular. Stokoe et al. (1965) described the sign for remember as moving "the right fist downward in an arc, finishing with the ball of the thumb pressed on the nail of the left thumb" (p. 61). However, in one case the same sign can mean I remember while in another it can mean Remember?; therefore cues other than those provided by the sign itself are differentiating a declarative from an interrogative sentence. To indicate Remember?, the signer raises his eyebrows and lowers his chin; I remember is indicated by slightly lowering the eyes, giving a tiny downward nod, or both.

Tervoort's Analysis--Tervoort (1961, 1967) has provided another approach to the study of sign language in deaf children. He is not convinced as is Stokoe that sign language is a separate language but believes that signing is the deaf's way of communicating in English (or Dutch as he has studied children in both the U.S. and Holland). Tervoort (1967) summarized his position as follows: "There is a growth from a level of communication that, certainly in part, is sublinguistic, through a level that shows both exoteric and esoteric features, towards an end that can be English, eventually to be termed a secondary system, or a blend of English and genuine features of a visual system that never reaches full adulthood in the data of the subjects as represented here" (p. 15).

Tervoort (1961) reported on the analysis of single symbols in the spontaneous (i.e., untaught) signing of deaf children 7 to 12 from English and Dutch-speaking schools. Pairs of subjects were filmed for 10 minute units and told to talk (via signing) about anything they wanted. Signs were translated as words. Tervoort referred to early signing of deaf children as involving the use of natural gestures which were concrete imitations of visual objects. For example, one 7 year old girl signed cat fish in the following manner: fish was made with the right plam placed on top of the back of the left with fingers held together but thumbs out making stretch-bend movements; cat was made with the index fingers and thumbs of both hands drawing a moustache from under her nose. Tervoort likened this kind of imitation to the onomatopeia phenomenon in spoken languages or in the use of words like slick, slimy, etc. which have emotional

connotations. The imitation must be very similar to the actual object or else the person who is receiving the sign will not recognize it. The signer is free to choose any aspect of the object to imitate or he can try to convey the total essence of it as in Tervoort's example of the 7 year old boy who had received a toy crane for Christmas and in telling his classmates imitated all the possible movements of the crane--more like a story or a sentence than like a single sign. Recognition of the sign requires knowledge of the situation and the context. Because of the above characteristics, many of the imitative signs made by the young children are situation-bound and don't tend to be repeated.

Tervoort explained that the imitative sign can become formalized and used consistently by the deaf children. If the imitation results in a new recognition and mutual understanding among the signers, it may come to be used by other than the original signer; the acceptance of the sign by others and the formalization of the language through a number of mutually accepted signs results in a language of signs used predominately by young deaf children. Tervoort gave one example of a new teacher coming to class who was immediately given a sign by one of the children which focused on her prominant dimples. The sign persisted for the teacher's name and in the meantime, the teacher became principal. Ten years later, the sign meant Principal even though there was a new principal who did not have dimples. This was a case where the original imitation was object-bound but current usage of the sign did not involve a knowledge of the original motivation.

Many of the signs do not lose their similarity to the object which makes abstract and metaphoric usage difficult. An example is the difficulty experienced by Dutch children with the concept of time because the sign imitated the swinging of a bell; understanding occurred for such concepts as _it's time to go_ or _time is up_ but not for _what time of the year do the cherries ripen_ or _time goes fast_. When the children were asked to sign _I like this man_ they did so by crossing the hands over the chest; Tervoort asked them if they meant to hug the man and the children, extremely shocked, told him that he did not really understand their language and that they just meant to say that they liked the man. When Tervoort then signed _I don't like milk chocolate_ with the same sign, the children laughed and said that you couldn't hold a candy bar in that fashion and that another sign must be used (chest rubbed downwards with right hand). Tervoort said that the children were unaware of the motivation of the sign until that original motivation was contradicted. He considered this as less complex and abstract usage. He failed to find many instances of metaphoric, idiomatic, or ironic usage of sign language; however, the children did use the sign for _baby_ to mean _immature_ and _what-a-much-hair_ for _bald_. Tervoort argued that words are not as tied to the referent and can be generalized to other situations to allow for more abstract usage.

Tervoort argues that sign language is more concrete and situation-bound than is English and that this is especially the case with the sign language of children which he calls "esoteric" as opposed to the exoteric adult form of signing whose symbolism is based much more on agreement among signers

and not upon an imitation which is a faithful reproduction of the object. Since the early speech of hearing children has also been described as concrete and situation-bound, Tervoort's analysis should not be taken as a criticism of sign language but possibly as a comment on early child communication in general. Not all of Tervoort's examples seem to justify his conclusions about the nature of young children's sign language. He viewed the need for 2 signs for "like" as an example of the restrictiveness of the motivations for these signs (i.e., a signer can't use the hug sign to indicate he likes a candy bar because you don't hug candy bars). It seems that English operates in similar ways in that words have selection restrictions; e.g., a verb like "see" must have a subject which has the property of animateness (butcher, woman, dog) while the verb "skate" usually has a human noun subject. Selectional restrictions operate on the use of adjectives and adverbs also; e.g., it is admissible to produce "John rolled off the table ingeniously" but not *"the rock rolled off the table ingeniously" (Jacobs and Rosenbaum, 1968, pp. 59 and 230). Tervoort seems to have accepted the view that language influences thought, a question which has not been definitively settled by any means.*

In addition, Tervoort claimed that the only way in which a sign not marked for tense can be understood time-wise is through the signer's knowledge of spoken and written English; i.e., the morphological markers are accepted as present by signers on the basis of their familiarity with the presence of

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*Dr. Philip S. Dale provided helpful suggestions for this discussion.

these markers in English. Data were presented which indicated that most deaf children and adults do not have a functional grasp of the English language. That leaves Tervoort with the o option of concluding that the concepts of past, present, future are not used or understood in manual communications because of the lack of inflectional endings. Chinese has already been mentioned as another language in which tense is not inflected but where the period of time is understood through use of situational and contextual cues. Therefore, Tervoort's statement does not seem to be justified in light of existing data. However, there is a need for a systematic investigation of deaf children's conception of time. Such studies must be designed to test hearing impaired children in sign language and English and not just in English and these data should in turn be compared with data from hearing children. It is not clear whether deaf children have a different sense of time but it is clear that other full-fledge languages do not inflect for tense, that deaf children do not add tense cues through their knowledge of English, and that the deaf denote time periods through the general context in which signing takes place.

Tervoort (1967) analyzed the syntactic and structural patterns of the Dutch and American children's sign language. He translated signs as words and noted that American deaf developed English word order while the Dutch developed Dutch word order. Depending on the facility subjects had with English or Dutch and considering the pressure in society and school for tailoring communication patterns in terms of the dominant language, it is quite possible that Tervoort's subjects signed

"correctly" to as great an extent as possible; i.e., signing for Tervoort and being filmed at the same time might produce a different brand of sign language than that produced by the deaf children back in the residence hall. The analysis of the structural patterns was solely in terms of how it deviated or was similar to Dutch or English structure; i.e., a construction was considered ungrammatical if it did not present the same structure as found in English or Dutch. Tervoort found that with greater length of sentences, younger and older deaf children used less grammatical constructions. He noted that the subjects used words along with signing while in the primary grades but used signing alone after this point. No relation was found between speech and spelling abilities and language abilities.

The work by Stokoe (1960, 1965, 1970c) and McCall (1965) leads this author to conclude that sign language can be considered a language in the same sense as is English. Tervoort's (1961, 1967) work, although very interesting and informative, does not provide an adequate basis for arguing that sign language is not a language since Tervoort did not analyze sign language on a linguistic basis but only in terms of how it deviated from English or Dutch. Sign language is used with consistency among a minority population in this country; although there is evidence of dialect differences due to geographic and social boundaries, signers across the country can understand one another using American Sigh Language. Due to the prestige of the majority language, English, signers, depending upon the level of education attained and facility gained in English, will communicate via signed English especially with hearing persons who sign. However, among themselves, the average deaf person

who does not know English will communicate with a sign language which Stokoe characterized in the following manner.

> Seen as a whole system, however, sign language is quite like English or any other language. Its elements contrast with each other. (Visibly instead of audibly.) They combine in certain ways, not in others. These combinations, signs, 'have meaning' as words or morphemes do. Constructions combining signs, like constructions combining words, express meanings more completely and complexly than single signs or words can. These constructions or syntactic structures are systematic, rule-governed structures. But there is a unique set of rules for making sign language constructions just as there is for making standard English constructions, non-standard English constructions, or the constructions of any language. (1970, p. 6)

Descriptions of sign language syntax have by no means reached a stage of completion and much work remains to be done in identifying the rules by which signs are combined. The next section of the paper will be concerned with investigations of the effect of early oral versus early manual communication upon later learning of English. Proponents of the oral method contend that early signing is detrimental to the learning of expressive and receptive skills in English.

Effect of Early Oral Versus Early Manual Forms of Communication

Review of Basic Studies—Vernon and Koh (1970) presented the following table (Table III) which summarized studies comparing the effect of early manual and early oral forms of communication on deaf children's later educational achievement, communication skills, and psychological adjustment. This paper is concerned with only the first two variables and discussion will be limited to these areas. In general, the data show that children exposed to manual or a combined form of manual and oral training were superior to those children who experienced only oral communication.

TABLE III

Results of Early Manual Communication

Investigator	Sample	Results
Meadow (1968)	56 deaf children of deaf parents (manual group) 56 matched deaf children of hearing parents (oral group)	1) manual group better in reading (2.1 yrs.) 2) Manual group better in math (1.25 yrs.) 3) Manual group better in overall education achievement (1.28 yrs.) 4) Manual group better in social adjustment 5) No differences in speech and lip-reading 6) Manual group better in written language
Stuckless and Birch (1966)	105 deaf children of deaf parents (manual group) 337 matched deaf children of hearing parents (oral group)	1) No difference in speech 2) Early manual group better in speech-reading 3) Early manual group better in reading 4) Early manual group better in writing 5) Early manual group possibly better in psycho-social adjustment
Montgomery (1966)*	59 Scottish children	1) Exposure to, use of,

*The Montgomery study did not involve preschool manual communication specifically.

Table III (continued)

Investigator	Sample	Results
Montgomery (continued)		and preference for manual communication did not negatively affect speech or speech reading skills
Stevenson (1964)	134 deaf children of deaf parents (manual group) 134 deaf children of hearing parents (oral group)	1) 90 percent of manual group did better than matched oral students 2) 38 percent of manual group went to college versus nine percent of oral group
Quigley and Frisina (1961)*	Sixteen non-residential deaf children of deaf parents (manual group) Sixteen non-residential deaf children of hearing parents (oral group)	1) Manual group better in vocabulary, the same in speech-reading and better in educational achievement. Oral group better in speech.
Hester (1963)	Deaf children in New Mexico School for Deaf. One group had finger-spelling beginning at school age, one group taught orally.	1) Fingerspelling group superior on standardized achievement tests.
Quigley (1969)	Sixteen orally educated deaf children matched with sixteen combined orally and manually educated deaf children.	1) Combined manual oral children did better in language, speechreading and general academic achievement

*Correction: 70 children in oral group

Manual group also better in fingerspelling.

Table III (continued)

Investigator	Sample	Results
Denton (1965)	The academic top ten percent of deaf children ages twelve, fifteen, and eighteen from 26 schools for deaf. Manual group had deaf parents, oral group hearing parents.	1) Mean achievement test score of manual group 8.2, of oral group 7.7.

Vernon and Koh, 1970, p. 528

There are two related general assumptions involved in the above research: (1) deaf children of deaf parents learn to sign early in life and this is the major form of communication between child and parents; (2) deaf children of hearing parents do not learn to sign during infancy, the major form of communication between parents and child being oral. Regarding assumption (1), Meadow (1967) cited Rainer et al.'s (1969) finding that approximately one half of the sample used only signs to communicate while another 18% used signs and speech as substantiation of the fact that her deaf children of deaf parents would be exposed early in life to signing. She also cited Birch and Stuckless's (1964) findings that 64% of the deaf parents used signs when the child was a baby and only 5 out of 71 stated that they were not using signs at the time of the study. Therefore, in her family questionnaire, Meadow simply asked "Does your family use only signs and fingerspelling, or do you sometimes speak to each other?" (question 45a, p. 348). She found no deaf parents who didn't sign and no hearing parents who did sign. One can still

not be certain that the major form of early communication was signing when that information is not specifically requested although in most cases the assumption probably holds; the cause for doubt is found in the fact that even deaf parents have been influenced by the pressure for an oral approach early in life and by prohibitions against signing on the part of educators of the deaf and physicians. Birch and Stuckless (1964) on the other hand used only those children whose parents specifically said that they used signs when their deaf child was an infant; this would seem to be the better procedure to follow. The second assumption is commonly accepted because of the oral bias on the part of educators and physicians as mentioned above and also because of the desire of hearing parents to have their deaf children appear normal. Often the comparison in the above studies is between those who had exposure to early manual communication and those who did not. Although there is a very good chance that deaf children of hearing parents were exposed to early oral training, there is a difference between parents attempting to talk to their child and perhaps trying to teach him to lipread and actual enrollment in an oral preschool or Tracy Clinic course. A study by Vernon and Koh (1970) controlled very precisely for these variables.

Vernon and Koh (1970) were concerned about another methodological problem other than those mentioned above. In all but one of the studies listed in Vernon and Koh's table, the deaf children of deaf parents (i.e., manual groups) were hereditarily deaf, whereas there were both exogenous and genetic etiologies involved in the oral or control groups. If deafness

results from exogenous causes, there is a likely possibility of brain damage and related learning disabilities. Meadow (1967) and Birch and Stuckless (1964) and the others were cognizant of this problem but there is still the chance that the superiority of the manual group might be due to these additional handicaps in control subjects. Therefore, only subjects with a genetic deafness were used in the study. In addition, the manual group was composed only of subjects whose parents said they had used signs from infancy. Twenty-seven (at one point, the authors said 30) of the 32 control subjects had preschool experience; 10 subjects went through the 3 year Tracy Clinic (strictly oral approach) preschool course. Only 8 of the manual group had any preschool experience. Since the great majority of deaf preschools use an oral approach, the manual and oral groups are better differentiated in this study than in any other one.

Only the data on educational achievement and communication skills will be reviewed here. The manual group was ahead by 1.2 to 1.6 grade years on all four measures of the Stanford Achievement Test (i.e., overall average for the test battery, reading average, Word Meaning, and Phrase Meaning). Although the manual group exceeded the oral group by at least one year at each level, the difference was not significant with increasing age. The deaf groups did significantly worse on all 4 variables than did hearing children; deaf children improved at about one-half to two-thirds the rate of hearing children. The results on the achievement test scores were consistent with data collected by Meadow (e.g., grade average, reading, and arithmetic).

Vernon and Koh also reported that the manual group "had greater success entering college, graduated with higher academic honors, and had fewer students who failed to earn a diploma" (p. 532). Even though the deaf parents had much lower levels of education than did the hearing parents, they were able to communicate the knowledge they had via the language of signs. The authors also noted that since more of the oral group had preschool experience than did the manual group, the manual group was educationally disadvantaged initially. They contrasted the fact that the effects of oral preschool training had been found to dissipate by age 9 with the continued one year (at least) superiority of the manual group over the oral group; they further pointed out the impressiveness of this continued one year superiority given the fact that Wrightstone et al. (1963) reported less than a one year reading gain for deaf students from age 10 to 16. Regarding communication skills, the manual group was significantly better in written language; the two groups did not differein terms of speechreading and speech intelligibility. The fact that the manual group performed better on tests of reading and written English indicates that early manual communication is very helpful in developing both r receptive and expressive skills in English. A telling blow was struck at the early speech training approach when the manual group did as well on measures of speechreading and speech intelligibility; this result was also reported by Birch and Stuckless (1964) and Meadow (1967). The authors made a plea for a reevaluation of current educational practices for deaf children and note the possibilities for combined oral and manual

methods with deaf children of hearing parents. They are pessimistic about changes occuring very quickly noting that "Vested interests are capable of elaborated and sophisticated rationalizations" (p. 535). Readers are directed to an excellent review of psychological and sociological variables involved in deafness by Vernon (1969) which covers in detail the question of the effects of early manual and early oral training and communication.

This review of the studies comparing early oral versus early manual forms of communication has indicated that at the very least, teaching a deaf infant to sign will not be detrimental to later attempts to teach him English and in fact will improve his English skills. The data presented by Vernon (1969) and Meadow (1967) showed in addition that children taught to sign early in life will be likely to exceed those trained orally on measures of educational achievement. However, none of the studies attempted to compare the two groups of deaf children on basic cognitive tasks such as those conducted by Furth and to be described in a later section. Studies are needed in which children who have learned to sign and those who haven't are compared on Piaget-type tasks such as conservation, on tests of memory and perception, etc. A test of the function of language in cognitive functioning must include comparisons of signers and non signers given this author's view that sign language is a language on the same order as is English. The importance of the early oral versus early manual studies for an evaluation of the deaf as linguistically deficient is twofold. If early manual communication produces a deaf child with better

English skills than a child exposed to early oral training, then studies using the strict criterion for linguistic deficiency (i.e., deficiency in English) must carefully control for the form of early communication. When sign language is considered a language, these studies and the few data on acquisition of sign language indicate that subjects trained from infancy in American Sign Language would not be linguistically deficient but comparable to a hearing child who knows one language, English.

Acquisition of Sign Language--None of the studies reviewed above looked at the process deaf children went through in learning sign language. The studies comparing the effects of early oral versus early manual forms of communication all took place after the child had acquired sign language and were concerned with the effect of the type of communication upon later school achievement and language functioning. The acquisition of sign language in young deaf children should be of interest to general theories of language acquisition and should also be helpful in comparing the structure of sign language to that of other languages. The following questions come to mind: do deaf children learn the language of signs in a manner similar to the way in which hearing children learn language?; are signs harder to learn?; when does the deaf child of deaf parents begin to produce signs? etc.

Olson (unpublished paper, 1969) reported on acquisition of signs in a deaf infant with hearing parents who had learned signs. Training with the aid of a speech therapist was begun when the child was one year old. The first sign he responded to was <u>baby</u> while the first sign he used was <u>eat</u>. By the

time the child was two years old, he had receptive and expressive command of 87 signs, 10 of which he invented. He is currently being exposed to a combined oral and manual language approach. No mention was made in this report about whether the child combined signs.

Meadow (1967) gave two anecdotal reports of deaf mothers of deaf children involved in her study. One mother who had two deaf children said that both signed very well before one year of age. Another mother reported her doctor's amazement at the fact that her deaf child knew almost 100 signs at one year of age.

Larry Peterson an Educational Specialist in Deaf Adult Services at the Seattle Hearing and Speech Center (personal communication, April 1971) reported that his deaf child used her first sign at 8 months. At 12 months, she was combining two signs; Mr. Peterson noted that she combined the sign for more with other signs (often signs for food). At 18 months, she was producing some three sign combinations and by 2 years of age, she was producing longer combinations of signs. Mrs. Mildred Johnson, Vocational Specialist for the State Office of Vocational Rehabilitation, reported to the author (personal communication, April 1971) that Mr. Peterson's child was signing phrases like kitty eat at about 18 months. Both Mr. Peterson and his wife are deaf and used signs to communicate with their child from infancy.

Bellugi (personal communications, December 1970 and April 1971) has been studying the development of sign language in a deaf child of deaf parents. Spontaneous mother-child

interactions were filmed on video tape beginning when the child was about two and one half years old. Various tests of comprehension have been used and Bellugi is convinced that the child who is signing quite extensively understands the signs she is using plus others that are signed to her. English word order has not been observed in her signing but the child's deaf parents do not use English word order either. Bellugi has been impressed with the similarities in language development which she has observed between the deaf child and hearing children. In particular she noted the presence of overgeneralization. For the first couple of months, the child indicated negation by either shaking her head or moving the finger back and forth. In ASL, the sign for no when the signer means No, I won't do it, involves bringing the index, middle finger, and thumb together in one motion and is usually done several times. The use of these two signs is comparable to the first uses of the negative in hearing children's speech such as no he do it. Bellugi described subsequent development in terms of the "flowering of various negatives" and noted the appearance of the signs for not, none, and can't. In addition, the child appeared to have extracted the negative component or an element common to various negative signs (e.g., turning your hand down and moving it away from yourself) and was now using this component to invent new signs (e.g., don't want, don't know and bad). In signing the concept don't want, the child made one sign incorporating the negative component into her sign for want; the child was producing the signs for want and know in an affirmative sense at this time.

Adult signers have a general sign for not which involves bringing the A hand out from under the chin and down; this sign takes the place of a word like don't, didn't, or doesn't, even though it technically stands for not or n't. However, it is also true that adult signers would express don't want, don't know, bad, and misunderstand with single signs (i.e., they would not sign not + verb); the signs for these concepts all involve a common movement, that of pronation, to which Stokoe et al. (1965) have ascribed to morphemic character since this Sig chereme is used consistently to negate concepts.

Bellugi indicated that the child was in a sense overgeneralizing the use of n't through extending it to her use of words like bad and through her incorporation of the two concepts, n't and Know into one sign. Since the child's signs for these concepts did not quite match that used by adult signers but still evidenced consistent use of the negative component in forming the signs, one can conclude that the child is extracting some sort of rule in forming these signs. However, it does not seem that in the strict sense of overgeneralization, these signs show an overgeneralization of the rule, "negate a concept by including the pronation chereme in the sign," since adult signers use the same rule for the same signs. Although it could be argued that adult signers add the pronation movement to their sign (the sign for don't want involves signing want and then turning your hands over so that the palms end up facing down), while the child just used a single sign, the fact is that the pronation movement does not mean anything to the signer unless it is considered in terms of the other cheremes of the sign. In addition, several concepts do not simply involve making the

affirmative concept and including the pronation movement but involve a different sign which ends with the palm down in some fashion (e.g., misunderstand and don't care). Further, many signs involve more than one motion; ie., the dez moves from one position on the body to another often changing its configuration. It would be interesting to see if the deaf child used her version of the negative component to produce the signs for hate and won't or refuse which don't involve the pronation chereme but still carry the concept of negation.

Bellugi (personal communication, April 1971) provided another example from the child's signing development which is much more analogous to the phenomenon of overgeneralization in hearing children's language development (i.e., children's change from the use of went to goed after discovery of the rule for adding -ed to form the past tense). In a previous section, the use of direction of the verb sign to indicate subject-object distinctions and its importance as a syntactic feature of sign language was discussed. Both Bellugi and Stokoe have commented on this feature of sign language. In addition, Bellugi has observed in the signing of the deaf child the overgeneralization of this direction rule to verbs which do not evidence change of direction by adult signers. For example, the child in requesting her mother to fingerspell to her (i.e., you spell me) turned her hand with the fingers wiggling in toward herself; the sign is normally made with the palm facing out from the signer with the fingers wiggling. The child was indicating that she wanted someone to spell to her. It is interesting to speculate on the intriguing examples provided by Bellugi's study. The fact that

some similarities intthe acquisition of both sign language and spoken English have been observed is all the more reason to conduct more observations of the learning of sign language in deaf infants.

The Gardners' (1969, 1969 and 1970) attempt to teach two-way communication to an infant chimpanzee named Washoe will not be discussed in this paper because there has not been a full scale investigation of sign language acquisition in deaf children; such data are needed in order to evaluate Washoe's success in learning sign language. Since Washoe was exposed only to signs, her language experience is comparable to that of a deaf child of deaf parents and such a comparison will prove very interesting. It is also possible to compare Washoe's language development to that of hearing children and this has been done by Brown (1970) and by Bronowski and Bellugi (1970). In addition, it is tempting to use the evidence of rule governed signing found in Washoe's communication with the Gardners as further evidence for the viewing of sign language as a language, one of the major concerns of this paper. However, until Washoe's signing can be systematically compared with the early signing of deaf children, one cannot be certain that "Washoese" is similar to the sign language produced by young deaf children. The Gardners are certainly to be applauded for such an innovative experiment and for the success they have had. Given the above qualifications, this author cannot resist mentioning Stokoe's (1970) comparison of Washoe and a deaf child twice her age in a school stressing only speech and speechreading; Washoe's vocabulary is about twice as great as that of a deaf child exposed to the oral method of training.

A contextual approach to understanding the relationships in young children's speech is alluded to by Brown (1970) but is much more fully presented by Bloom (1970, 1971). Bloom's attention to context provides a more adequate approach not only th the study of meaning in young children's early combinations of words but also of the combinations of signs in American Sign Language in general. Bloom described children's speech in terms of two types of semantic relations, functional and grammatical. In the first type of relation (functional relation), certain words (e.g., no, more) are paired with referent words in order to characterize that referent in some way (e.g., no pocket to indicate the nonexistence of the pocket, more raisin to indicate the recurrence of raisins); such pairings have invariable grammatical meaning. Words like no and more occurred in a fixed position with a number of other words and words meeting such a description hav been called pivots (see Braine, 1963). However, Bloom said the important feature of these words was that they "shared features of context and behavior" and "occurred with specific semantic intent, either in relation to the words with which they were juxtaposed or with inherent relation to the something not specified, in the case of single-word utterances" (p. 43).

The second type of semantic relation described by Bloom is one where the relationship between the constitutients is variable depending upon context. Bloom found the following types of grammatical relationships; subject-object (most frequent), genitive, attributive, subject-locative, and conjunctive (rarely occurred). Bloom, like Bronowski and Bellugi (1970), spoke of the child's construction of events and objects as he sees them in the world; he talks about the relations he perceives and develops

linguistic rules to reflect his concepts of the world. Bloom argued that in interpreting a combination like Mommy sock parents rely on context and situation features and that the child probably depends on these features in communicating his intent. To support her argument she noted how a word like Mommy could be classified as a pivot in the speech of Kathryn, one of the children observed by Bloom, since it occurred in 32 sentences (e.g., Mommy sock, Mommy haircurl). Mommy met the fixed position criterion for a pivot because it occurred in initial position 29 times; in addition, Mommy shared contexts with other words like no and more (e.g., no sock). However, Bloom objected to Mommy being classified as a pivot because it is not a function word and more importantly because Mommy could be shown to have different meanings depending on context even though its position in the sentence was the same; e.g., Mommy sock could mean the child picking up her mother's sock or the mother putting the child's sock on the child. Neither a pivot-open or an open-open grammar distinguishes between these two entirely different meanings. The use of Mommy sock in the two contexts indicates that the child understands the relations between Mommy and sock, in the first instance, a genetive relation and in the second instance, a subject-object relation.

The fact that you can observe the child's understanding of such complex relationships as the genetive and subject-object by attending to information other than language is an important point in the debate over whether sign language is not a language because it does not manifest all the syntactic markers present in English. It does not take a linguist such as Bloom to be aware of the child's understanding of these various semantic relationships. Parents use extra-linguistic cues everyday in interpreting

such utterances as Mommy sock. Certainly, the information provided previously about the importance of context and extra-linguistic cues in sign language indicate that deaf persons make use of such cues constantly and communication does not suffer because certain syntactic cues are missing. Bloom argued that Mommy sock was not an example of the child simply naming or joining features of the situation because variable order of the constituents should be the result; this was not the case since Mommy appeared in the initial position 29 out of 32 times in this sample of Kathryn's speech. However, consistent word order might not be the only cue that one could point to in refuting the argument that strings of signs might only represent concatenation; e.g., in sign language, context, facial and bodily expression, and reversibility of sign direction are all used to indicate linguistic relationships such as those discussed by Bloom. Tests of the sort proposed by Brown (e.g., "Show me, 'the duck pushes the boat'"--1970, p. 228) should be conducted with young deaf children to see if they do understand the various relationships in a sentence; such data should be compared with the data of hearing children of the same age. It would also be interesting to see if the "esoteric" signing by deaf children who learned to sign from their peers and which was described as very situation-bound by Tervoort is similar to the early speech of hearing children which Bloom and others described as reliant upon context. Although adult sign language depends more on context than the speech of adults, it may be that the contextual dependence of young deaf signers is aulitatively different from that of adult deaf signers; the cues used by adult signers may be more linguistic whereas this may not be the case for the young signer or the young hearing

child. In general, Bloom's approach has much to offer in gaining an understanding of both hearing children's speech and in better understanding the language of signs.

Conclusions about the effects of early signing--In this section, we have looked at whether teaching a young deaf child to sign early in his life will be detrimental to his later educational and communicative functioning. In addition we have attempted to compare the acquisition processes involved in learning English and learning American Sign Language. It appears that deaf children learn to sign with the same facility that hearing children to speak; unfortunately the information presented to substantiate this statement is largely anecdotal. Publication of Bellugi's study of the acquisition of signing of a deaf infant of deaf parents is eagerly awaited for a more comprehensive investigation of this question. Bloom's work is especially relevant to a discussion of how deaf children learn to sign because she emphasized the importance of the referent in children's speech. Deaf and hearing children's language can be more fully appreciated when the context of various utterances is considered; deaf adult signers and speakers of other languages such as Chinese also make considerable use of context and extra-linguistic cues. Finally, when children who have learned to sign early are compared with those who were not, the signers appear to come out on top in terms of communication and educational measures.

We will now review Furth's work in comparing hearing and deaf children and adults on various cognitive tasks. Following that review, will be a discussion of the problems sign language poses for Furth's conclusions about the role of language in cognitive functioning.

Summary of Studies Comparing Hearing and Deaf Subjects on Nonverbal Cognitive Tasks

Furth's Reviews--Furth (1966, 1970, 1971) has reviewed a sizable number of studies in which hearing and deaf children and adults were compared in terms of their performance on various nonverbal conceptual, perceptual, and memory tasks. The following table (Table IV) is taken from Furth's latest review (1971) and indicates whether the deaf performed in a similar or inferior manner to hearing subjects; the numbers in parentheses in the right hand columns refer to age differences in performance.

In general, deaf and hearing subjects perform in a similar manner on many of the tasks. However, there are also a number of instances in which the deaf do not do as well as the hearing subjects. At one point, Furth (1966) noted that the inferior performance seemed to be involved with tasks which required discovery of a principle (e.g., in his symbol discovery tasks and in various Piaget-type tasks such as conservation of liquid). On the other hand, when the deaf subjects were trained in the maaning of certain logical symbols, they were able to grasp the rules involved and apply these rules to new instances. Furth explained the failure of the deaf in discovery tasks in terms of certain rigid behavior patterns resulting from the drill-like educational methods used with the deaf. In addition, Furth noted the possibilities for misunderstanding of directions (e.g., conveying the question, "Which is more," nonverbally) in Piaget-type tasks. Unfortunately, as Furth (1971) has mentioned, the pattern of failure for the deaf subjects is not a consistent one; e.g., note the most recent Furth (1967) study of symbol use in which the deaf subjects were inferior to middle class hearing subjects.

TABLE IV

A Classification of Recent Studies with Deaf Subjects

No, Task and Age	Author	Topic	Performance of deaf in comparison to hearing subjects: Similar	Inferior or different
Rule Learning				
(1) 3-6	*Bland & Bridger, 66	Cross-modal transfe.	X	
((2) 4-6	Weigl & Metze, 68	Rule learning	X	
(3) 4-9	*Pufall & Furth, 66	Double Alternation	X	X (5,6)
(4) 6-9	Youniss & Furth, 66b	Discontiguity	X	
(5) 7-12	*Andre, 69	Reversal shift	X	
(6) 10-11	O'Connor & Hermelin, 65	Visual rules	X	
(7) 9-13	*Furth, 64	Combinatorial sequences	X	
(8) 6-10	*Furth & Pufall, 66	Combinatorial sequences	X (10)	X (6)
(9) 11-19	Goetzinger et al., 67	Raven's Matrices	X (18)	X (13)
(10) 17	Odom & Blanton, 67	Sequential rules	X	
(11) 15-19	Michael & Kates, 65	Social concepts	X	
Log. Symbols				
(12) 9	*Furth, 66	Logical symbol use	X	
(13) 16-20	*Furth & Youniss, 65	Symbol a) use b) discovery	X (a)	X (b)
(14) 10-14	*Youniss & Furth, 67	Symbol use		X
Piaget-type				
(15) 5-8	*Youniss & Furth, 65	Transitivity	X	
(16) 5-8				

Table IV (continued)

No, Task and Age	Author	Topic	Performance of deaf in comparison to hearing subjects: Similar	Inferior or different
Piaget-type (continued)				
(16) 5-8	*Youniss & Furth, 66	Transitivity	X	
(17) 4-12	Piaget, 66	Conservation tasks	X	X (2 tasks)
(18) 9-16	*Furth, 66	Quantity of liquid		X
(19) 6-9	Youniss, 67	Seriation		X
(20) 11-15	*Ross, 66	Probability	X (15)	X (11, 13)
(21) 8-12	*Robertson & Youniss, 69	Anticipatory images	X	
(22) 9-11	*			
(22) 9-11	*Youniss & Robertson, 70	Anticipatory images	X	X (9)
(23) 13-19	Furth & Youniss, 69	Formal operational tasks		X
Memory				
(24) 6, adults	*Lantz & Lenneberg, 66	Color recognition	X	X (6)
(25) 7-10	Youniss & Furth, 66b	Recognition strategies		X
(26) 8-12	Withrow, 68	Sequence a) simult. b) succ.	X (a)	X (b)
(27) 6-16	Rozanova, 66	Pictures	X (15, 16)	X (9, 10)
(28) 7-15	Roxx, 69	Symbol span	X	
(29) 14-18	Goetzinger & Huber, 64	Design reproduction	X	
(30) 13-20	Conrad & Rush, 65	Type of encoding		X
(31) 12-17	*Conrad, 70	Type of encoding		X

Table IV (continued)

No, Task and Age	Author	Topic	Performance of deaf in comparison to hearing subjects: Similar	Inferior or different
Perception				
(32) 4-6	Oleron & Gumusyan, 64	Embedded figures		X
(33) 6-11	Yashkova, 66	Figure reversal	X (9-11)	X (6-8)
(34) 11-16	Gozova, 66	a) Recognition b) Drawings	X (a)	X (b)
(35) 7-12	*Suchman, 66	Preference a) color b) form	X (a)	X (b)
(36) 8-18	Carrier, 61	Color-weight association	X	
(37) 5½-10	Costa et al., 64	RT a) visual b) bimodal	X (a)	X (b)
(38) Adult	*Stoyva, 65	EMG and REM in sleep	X	
(39) Adult	Furth, 61	Size-weight illusion	X	

*References for the studies so marked can be found in the Reference Section of this paper; references for the other studies can be found in Furth, 1971.

Furth, 1971, p. 34

Furthe Furthermore, although there is a tendency when inferior performance occurs for younger deaf subjects to fail on the task and older deaf subjects to catch up or succeed on the task, success or failure is not solely a developmental phenomenon.

Furth concluded, on the basis of the above studies and many others, that language cannot be a necessary element of cognitive functioning if deaf subjects (whom he assumed to be linguistically deficient) can perform cognitive tasks as well as hearing subjects can. In addition, when the deaf subjects fail, Furth has argued that language variables cannot be considered automatically responsible because of the existence of many uncontrolled variables. For example, Furth explained both the developmental differences and much of the inferior performance in general to experiential deficiencies resulting from deafness; the experiential deficiency is indirectly related to langage in that language enables hearing children to more fully interact with their environment, to acquire factual information, etc. Older deaf children have the advantage of more contact and interaction with the world around them which is sufficient to enable them to improve their performance. The Wrightstone et al. (1963) data showing a one year gain in reading level from ages 10 to 16 is used to substantiate Furth's contention that the deaf have not improved linguistically but only experientially. Furth (1965, 1967) also found that deaf subjects performed more similarly to rural and American Indian subjects than they did to middle class subjects; the deaf were likened to the rural and Indian subjects in terms of possessing a deprived environment. Furth (1971) did raise the question of whether the age improvements would be found with more complex tasks and more stringent

criteria for success; likewise, he noted that failure in tasks might be avoided with appropriate types of training. He currently is investigating the factors involved in the question of training.

Criticisms of the Deficiency Experiment--Blank (1965) has criticized Furth for the use of the deaf as a nonlanguage control group. She noted the oral preschool experience of many deaf children and the fact that many concepts such as numbers, colors, and size are stressed. Furth (1966, 1970, 1971) replied to this criticism by pointing out the almost total failure of the oral method in teaching Ehglish to the deaf; the fact that the average reading level of even deaf adults is comparable to that of a hearing third grader was cited as evidence of a lack of competence with the structure of the English language. Furth noted that if language did influence thinking, its impact would not be due to single words but in terms of the structural relationships among those words in the language. This author feels that Blank's criticism is valid for several reasons. It is clear that deaf children and adults do not have either expressive or receptive skills in English; the effect of oral preschool would be minimal in terms of producing deaf children with competence in the English language. However, Blank is probably right in saying that older deaf preschool children know some words like one, two, big, small, red, green, etc.; personnel at the Seattle Hearing and Speech Center's preschool for deaf children told this author that their four and five year olds understood some words of this sort. In addition, it is reasonable to expect that young deaf children have developed a communication system of gestures which as

Tervoort (1961) has suggested might be very situation-bound and not at all like the sign language of older children and adults but which could still be capable of providing language symbols for words like big and two and opportunities for experience with these concepts. Deaf children who had been provided with a manual form of communication from early infancy would be certain to have means of expressing these terms. However, one can still question the efficacy of these words or signs for hearing or deaf children when it is not certain whether children of this age have the dimensional concepts of number, size or color; i.e., the use of big and small to mediate the solution of a problem is dependent not just on the production and comprehension of these terms but on the understanding of their position on the size dimension as opposed to, for example, the values red and green on another dimension, color.* Blank is correct in stressing the need for better controls on the previous language, especially sign language, experience of young deaf subjects. More studies need to be done with preschool deaf subjects who have been exposed to early manual communication and those who have not in order to have a better control of the effect of language on the type of cognitive tasks used by Furth and others. If studies like that being conducted by Bellugi show that acquisition of sign language is similar to that of English, then it will be very interesting to compare preschool deaf children who sign with preschool hearing children at the various stages of language acquisition in order to test the effect of language on cognitive functioning.

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*The author is indebted to Dr. Philip S. Dale for pointing out this problem.

Although it is questionable what kind of language symbols deaf preschool children have available, there is no doubt that probably by age 12, most deaf children are very fluent in American Sign Language and therefore are not linguistically deficient. In most residential schools, signing is used in classes after this point aside from the more important factor that the child has had several years of experience in the deaf dormitories where communication is by signing; once a deaf child has been exposed to a population of deaf children for any great period of time, he will learn the language of signs very easily. Blank (1965) suggested that after six years of age, the deaf could be characterized "not as a language-deprived group per se, but a group deprived of language in the early years"; therefore when the deaf do as well as the hearing we may only be able to conclude "that contrary to a critical-periods type of hypothesis, early language acquisition may not be essential for the effective use of language" (p. 443). This factor is especially relevant to the age improvements noted by Furth. Although it is clear that deaf adolescents have not improved their understanding and use of English language structure, Furth is ignoring the presence of such structure in the sign language of these subjects; this author feels that a convincing argument can be made regarding the consideration of American Sign Language as a language. Therefore, improvements noted by Furth and other researchers could be due not only to increased experience and interaction with the environment but to the lately acquired opportunity to relate to that environment via a language system. Unfortunately the data don't exist to be able to answer this question confidently. It appears to this author that Furth is incorrect when he considers deaf adolescents to be linguistically

deficient and then goes on to infer that language is unimportant in cognitive functioning when these subjects perform like the hearing controls. He is probably on much safer ground when he makes this assumption about young deaf children as long as they have not learned sign language during the normal language acquisition phase.

Furth's contention that the young deaf child is experientially deficient in a manner similar to that of a culturally deprived hearing child is all open to question. It is interesting to note that culturally deprived children usually do not show improvement in tests of cognitive functioning and educational achievement with age, but to the contrary, often show deterioration in performance (i.e., the cumulative deficit hypothesis).* Therefore, it would appear that some other factor is involved. Actually, there has not been a direct test of this criticism since developmental data were not reported for the Indian sample and Furth's rural sample showed an increase with age as did the deaf. This question needs to be considered in a more systematic developmental sense; over some age range, hearing culturally deprived subjects should be compared with young deaf who do and do not sign and older deaf who do sign (the only older deaf who wouldn't sign would be those who had been successful in learning to speak and lipread English and who looked down on signing).

Data Which Conflict With Furth's Interpretation--Furth (1970, 1971) reported a study by Lantz and Lenneberg (1966) which

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*Discussions with Wendy Shelton, a fellow graduate student, brought this point to light.

investigated memory for color and communication ability in deaf and hearing subjects (six year olds and college undergraduates). All subjects participated in a recognition task which involved picking out two hues presented five seconds before from an array of 43 hues. Additional hearing six year olds and deaf and hearing undergraduates participated in the Communication Accuracy test which involved dividing subjects into encoders who named the colors and decoders who had to pick the colors on the basis of the names given by the encoders. Lenneberg had previously found that memory for colors was significantly related to ability to communicate or label the colors. He was therefore interested in seeing how persons with a limited language system would do on a task which had been shown to correlate highly with a language variable; in addition, Lantz and Lenneberg were interested in seeing whether the Communication Accuracy test would predict memory performance for the deaf even if they appeared to use language differently from the hearing subjects. Recognition performance improved with age but Communication Accuracy did not. Hearing six year olds did better on the memory task than did deaf six year olds but deaf adults did not differ significantly from hearing adults. These results are consistent with a Furth interpretation because Furth could say that the younger deaf suojects lack general experience with the world which the deaf adl adult has more opportunity to acquire.

However, attempts to look at the relationships between the tasks for the various groups provided some very interesting data. The Recognition and Communication Accuracy tasks were significantly correlated for the hearing children and for both adult groups backing up Lenneberg's hypothesis that performance

on the two tasks was related. Adult hearing and deaf subjects appeared to use language differently since there was not a significant correlation between them on the Communication Accuracy test; however, hearing children and adults did appear to be using language in a similar manner. In addition, deaf children and adults have a similar pattern of errors for recognition performance (correlation of .73 as opposed to .47 for hearing children and adults). Given this similar pattern of responding between deaf children and adults, Lantz and Lenneberg wondered if (1) deaf children were less language deficient than they thought or if (2) language develops after cognitive skills have developed. The authors stated that both interpretations would lead to a prediction of a high correlation between recognition scores of the deaf children and Communication Accuracy scores of the deaf adults; since the obtained correlation was .10, the authors rejected both proposed explanations for the similar recognition performance of deaf children and adults given the fact that Communication Accuracy predicts deaf adult recognition performance. Instead, the authors indicated that since deaf adult Recognition performance could not be totally predicted from knowledge of the children's Recognition scores then there must be some other variable affecting adult peformance which is not affecting the children's performance; this other influence is the increased facility which the deaf adults show in the English language which acts as a mnemonic device.

However, this author feels that Lantz and Lenneberg took a somewhat simplistic approach in dismissing the two interpretations noted above, especially the view that cognitive skills develop

prior to language skills. The increased cognitive skills of the deaf adults could still be accounting for the improved performance of the adults and for the lack of a correlation between Recognition scores of children and Communication Accuracy scores of the adults; both Furth and Piaget claim that language is used more at later stages of cognitive development. Furth might be able to counter the interpretation chosen by Lantz and Lenneberg by appealing to Piaget's (1968) theory of memory which predicts an improvement with time as the operations become more complex; data exist to support such an improvement over time. A better test of Lantz and Lenneberg's contention would be to add a group of six year old children who had been trained to sign during infancy. This author would expect no difference between the hearing and deaf children in this case. In addition, if young deaf signers were compared with deaf adults who were being tested for Communication Accuracy both in English and signing, this author would predict a greater correlation between young deaf Recognition scores and signing adult Communication scores than was found by Lantz and Lenneberg.

Lantz and Lenneberg reported one other piece of data which is more difficult for Furth to handle than the above problems. The authors looked at whether deaf children did better on the first recognition choice rather than on the second one where the visual trace would have broken down; Lenneberg noted that when a task is easy, visual memory can be used and the use of a verbal label does not seem to be as crucial to task success. Recognition accuracy between the first and second choice differed at the .001 level for deaf children but no significant differences appeared for hearing children or for either adult group. Furth

did not report this data when he reviewed the Lantz and Lenneberg study; the data are difficult for Furth to handle since they provide some more support for a possible differential effect of language. The Lantz and Lenneberg study was reviewed in more detail in this paper because it is an example of the authors' offering of one interpretation of the data ("The results are consistent with the idea that a more adequately developed language system than the deaf children possessed is necessary to do well the kind of memory task used here."--p. 779) and the reviewer not reporting the full tone of the author's interpretation ("From these data the authors concluded that color categorization develops somewhat differently in deaf children and that the late acquired linguistic skill facilitates recognition without basically modifying the original patterning of colors"--Furth, 1971, p. 13). Furth did not really discuss the various interpretations one could make from these data and certainly did not interpret them in the same manner in which Lantz and Lenneberg did. The study does not provide a crucial test by any means and support appears to exist for both a Furth approach and a more language oriented approach. This study points up the difficulties in using the deaf as linguistic deficient subjects and then making conclusions about the effect of language on cognitive performance; unless sign language is considered, it is difficult to make any conclusions about the role of language.

The data on deaf subjects' ability to transfer principles from one situation to another do not present a neat picture. Table IV indicates that on the majority of rule learning tasks, deaf subjects performed as well as did hearing subjects. Furth cited a study by Andre (1969) in which a hypothesis that mediation

is due to language was not upheld because there was no difference in the number of deaf and hearing children choosing a reversal shift. A second hypothesis proposed that mediation is verbal in hearing children and something different in deaf children. Although Furth reported that there was no difference in the number of reversal shift choices between hearing subjects who could verbalize the solution and those who could not, he did not discuss Andre's revised definition of mediation which involved both making a reversal shift and the speed with which the shift was made in the second series of problems (the optional shift). Andre felt that if a mediator were being utilized by the subject, it should result in faster shifting in the optional shift task. He found that 40 of the 48 fast shifters in Series II were reversers in Series III while only 22 of the 48 slow shifters in Series II were reversers in Series III (represents chance performance). In addition, 20 out of the 22 fast shifters in Series II verbalized the solution correctly while only 10 out of 19 slow shifters verbalized correctly. When Andre used a conjunctive definition of mediation he found that 90% of the fast reversal subjects but only 40% of the slow reversal subjects verbalized correctly. He concluded that this provided fairly good evidence that mediation in hearing children may be verbal. Of course, there is the problem mentioned previously of talking about mediation on the basis of the child's production of words without data on his comprehension of dimensional concepts per se, but Andre's data still indicate that language may be utilized in the mediational processes of hearing children. How the deaf child mediates is not answered in this study. Subjects were 7 and 12 years of age and since there was no control for the

signing abilities of these subjects, deaf subjects, at least the older ones (reversal shifts increased with age for both hearing and deaf subjects), may have been mediating via the language of signs. Eleven of the 48 deaf subjects gave verbal responses as to the solution but these were not analyzed in the study. This study was mentioned again because there was not clear support for the absence of the influence of language on a cognitive task.

Another study by Kates (1969) and not cited by Furth (1971) found similar conflicting results. Comparisons involved deaf and hearing subjects matched on age, IQ, sex, and SES and deaf and hearing subjects matched on IQ, sex, SES, and comprehension of written language. Kates found that age was more important than language comprehension in acquiring logical concepts and in the ability to verbalize the concepts. However, of the nine deaf and hearing subjects matched for age who attained criterion in the test phase, eight were able to correctly verbalize the three concepts involved in the acquisition phase; four of the five deaf subjects reaching criterion in the test phase could verbalize the concepts. Kates suggested that ability to verbalize the principle aided subjects by "providing Ss with an ordering principle or cognitive structure which supports transfer behavior" (p. 705). He concluded that although subjects seemed to acquire the skill or intellectual operation before they could verbalize it, the verbalization of the rule or concept definitely improved transfer behavior. Again we see support for Furth's theory that language is not necessary for cognitive functioning but also support for those who say that language serves some mediating function. In this study as in most others, the possible influence of sign language was not controlled so that it is possible that

language was not controlled so that is is possible that the fact that the older deaf performed better than the hearing controls matched for comprehension of written English could be attributed to increased fluency and familiarity with American Sign Language.

Conclusions

The main purpose of this paper has been to evaluate the comparison of hearing and deaf subjects in studies investigating the language-thought issue.

Data were presented on expressive and receptive capabilities of the deaf with regard to the English language. It was shown that in general the speech of deaf adults in unintelligible to untrained hearing persons and therefore is nonfunctional. For this reason, many deaf persons resort to written communication when dealing with the hearing world. However, as was shown, the written English produced by hearing persons, especially with regard to omission of essential words (e.g., verb to be, subject, object). Therefore there is ample evidence that deaf adults do not produce English either in terms of speech or writing which can be considered functional in a hearing society. The same picture appeared with regard to the receptive skills of speechreading and reading. The fact that many deaf children are "taught" English via speechreading skills when speechreading is extremely difficult unless the person already knows English and its sequential dependencies is good evidence for the deficiency in English evidenced by these children as adults. Furth used the fact that deaf adults possess an average reading level which is below fourth grade standards as evidence for his

view that the deaf are linguistically deficient. If the criterion for linguistic deficiency involves comprehension and production abilities in English (which assumes a knowledge of the structure of the language) then Furth has used deaf subjects appropriately in the deficiency experiment paradigm.

However, the main point of this paper is that a broader criterion of language proficiency must be used; i.e., the term language must include proficiency in American Sign Language as used by the deaf in North America as well as proficiency in English. Sign language as analyzed linguistically by Stokoe (1960, 1965, 1970) and McCall (1965) was discussed and the similarities and differences between American Sign Language and English were presented. In terms of phonemic, syntactic, and semantic features, sign language was seen to offer a rich and complex structure and on the basis of these analyses, this author concluded that American Sign Language is a language in the same sense as is English. The effects of learning sign language at the same time hearing children learn their language was shown to not have a detrimental effect on later English communicative skills and for the most part to effect a positive transfer to the learning of English. Such data are important to the choice of subjects in a deficiency paradigm since even if the strict criterion (i.e., English) is used, deaf children exposed to early signing will be less deficient than will be deaf children exposed to early oral communication training. In addition, the limited data available on the acquisition of sign language by young deaf children was discussed in an attempt to point out the similarities which appear to exist in the acquisition of both

languages. These data were especially important in considering the importance of word order in conveying ideas and whether the lack of word order in sign language is a crucial deficit in deciding if sign language is systematic or not. In American Sign Language, other cues serve the function provided by word order in English, context being very important. The fact that context can be used to more fully explain the utterances of young children and this supports and is supported by the similar situation in sign language.

On the basis of the above data on sign language it was concluded that children who learned sign language in infancy, children who had learned sign language through informal contact with other deaf children, and deaf adults who for the most part are fluent signers are not linguistically deficient. The question becomes more sticky when one considers the early informal type of sign language generated by children when they are not provided with a model of the adult version of sign language as are hearing children. Furth is probably using these subjects more appropriately in his deficiency experiment than he is using older children and adolescents. The problem is that this early signing has not been analyzed in the same sense as has the adult version of sign language; i.e., Tervoort (1961, 1967) described an esoteric form of signing in young deaf children in terms of how that signing deviated from English and Dutch and not in terms of the linguistic structure present in the signing itself. Linguistic analyses such as those conducted by Stokoe need to be done with regard to early signing patterns which develop among young deaf children; there is a need to see what differences exist between

the acquisition of this informal signing and the acquisition of sign language by young deaf infants of parents who sign.

Furth's data on comparison of hearing and deaf subjects in various cognitive tasks were briefly summarized. These data are very convincing evidence that the deaf do as well on many tests of cognitive functioning as do hearing subjects. This author feels that the basis for that similarity in performance has not been adequately answered by Furth's use of the deaf as control subjects in a deficiency experiment. Given that considerable evidence was presented in this paper as to the consideration of American Sign Language as a language and in view of the fact that most deaf adolescents are fluent in sign language, one can not dismiss the influence of language when hearing and deaf subjects perform in a similar manner. The basis for the similarity in performance may be because both hearing and deaf subjects are utilizing whatever language system is available to them. Given the data which provide problems for Furth's interpretation (e.g., Lantz and Lenneberg, 1966) and the inappropriate use of deaf adolescents, at least, as linguistically deficient, one must conclude that the deficiency experiment has not provided indisputable proof for Piaget and Furth's view on the language-thought issue.

Several suggestions for needed research have been made in the paper. Many of these suggestions have centered on the need for more <u>linguistic</u> analyses of the signing of young deaf children. The question of whether Tervoort's "esoteric speech" is an adequate way of characterizing the signing of all young deaf children can only be answered by systematically comparing the signing of deaf children of deaf parents (assuming that signs

were used from infancy) with the signing of deaf children who don't have a deaf adult for a signing model but who learn signs from their peers. In addition, the language of these two groups should be compared with that of hearing children of the same age to see if deaf children's language is more concrete. The early signing of deaf children of deaf parents should also be compared with the early language of hearing children, as Bellugi is doing, to better understand the similarities and differences between the two languages. Bloom's contextual approach seems to offer a better way of appreciating the structure of sign language. The influence of signing must be teased out of the type of studies reviewed by Furth; are the age-related improvements really due to the lately acquired ability to sign? In addition, deaf children exposed to early manual communication must be compared with deaf children exposed to early oral communication on various cognitive tasks. A comparison of the performance of these two deaf groups with hearing children provides a better test of the influences of language. Deaf children who grow up signing and deaf children who learn signs after entering school could also be compared with hearing children on concepts such as time which are represented differently in the languages.

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